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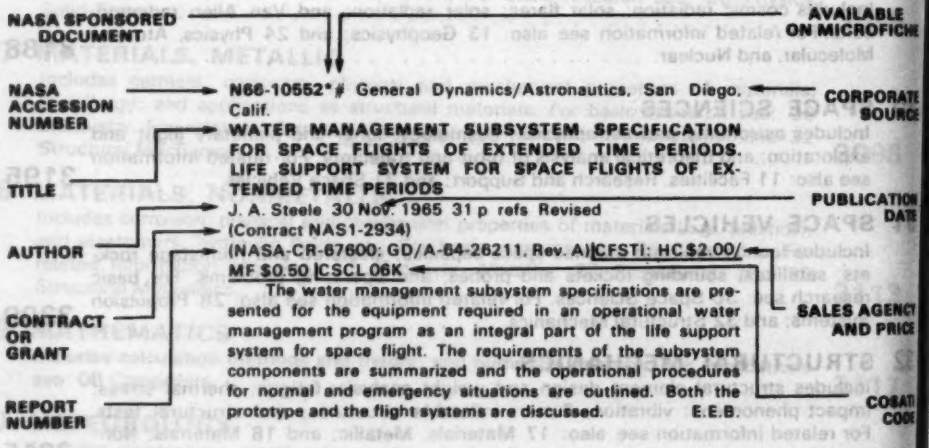
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N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
CONTRACT OR GRANT
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
REPORT NUMBER
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
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VOLUME 4 NUMBER 16

Scientific and Technical Aerospace Reports

A Semimonthly Publication
of the National Aeronautics and Space Administration

August 23, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-28541# Aeronautical Research Council (Gt. Brit.)
FORCES ON AEROFOILS WITH BOTH INCIDENCE AND FORWARD SPEED VARYING
D. G. Randall London, HMSO, 1965 30 p refs Supersedes RAE-TN-STRUCT-357; ARC-26190; See X64-18051
(ARC-R&M-3414; RAE-TN-STRUCT-357; ARC-26190) CFSTI: HC $2.00/MF $0.50

Determination of the inviscid, incompressible flow due to a thin, two-dimensional aerofoil moving with varying incidence and forward speed requires the solution of an integral equation. This report examines the case of harmonic variation of both incidence and forward speed (same frequency, different amplitude and phase). A solution is obtained in which the first terms neglected are of order (ν log ν)^2, where ν is the reduced frequency. Author

N66-28664# Rice Univ., Houston, Tex.
SUFFICIENCY PROOFS FOR THE PROBLEM OF THE OPTIMUM TRANSVERSAL CONTOUR
Angelo Miele and David G. Hull 1966 16 p refs
(Grant AF-AFOSR-828-65)
(AAR-18; AD-479071)

The problem of finding the transversal contour of a conical body of given length and base area which minimizes the total drag in hypersonic flow is considered under the assumptions that the pressure distribution is Newtonian and the skin-friction coefficient is constant. Both the case of a slender body and that of a nonslender body are investigated, and previous treatments concerned with the necessary conditions for the extremum are extended in that sufficiency proofs are developed. Specifically, three kinds of solutions exist: (1) circular arcs, (2) combinations of straight line segments tangent to a basic circle, and (3) combinations of circular arcs and straight line segments tangent to the circular arcs. Their minimality is proved without the use of the Jacobi condition of the calculus of variations by exploiting certain particular properties of the coefficients of the second variation for the problem under consideration. Author (TAB)

N66-28677# David Taylor Model Basin, Washington, D. C. Aerodynamics Lab.
INCREMENTAL LIFT AND DRAG OF AN EXTERNAL AIRCRAFT STORE—PHASE II (50° SWEEP)
Charles S. Swinney Mar. 1966 94 p refs
(DTMB-AL-27; AD-481906)

A wind-tunnel study was conducted to determine the effect of store location, arrangement, and incidence, as well as the effect of aircraft wing leading-edge geometry, on the lift and drag characteristics of a generalized wing-body aircraft. Wind tunnel tests were performed at Mach numbers between 0.80 and 1.15 as aircraft angles of attack between −3° and 15°. The generalized wing-body aircraft had a wing leading-edge sweep angle of 50°. A similar study was conducted using the same generalized wing-body with a wing leading-edge sweep angle of 25°. Author

N66-28824*# Rice Univ., Houston, Tex. Aero-Astronautics Group.
OPTIMUM LIFTING WINGS IN NEWTONIAN FLOW Progress Report, Jan. 1–Jun. 30, 1966
Angelo Miele [1966] 72 p refs
(Grant NGR-44-006-045)
(NASA-CR-75781) CSCL: HC $3.00/MF $0.75 CSCL 01A

Methods of analyzing optimum two-dimensional or three-dimensional lifting wings in hypersonic flow are reviewed. The Newtonian theory is employed, and methods of the calculus of variations are used to optimize the lift-to-drag ratios for various classes of flat-top wings. Requirements imposed on the lift, planform area, frontal area, volume, root chord, span, and root thickness are considered with respect to similarity laws for chordwise and spanwise contours. S.P.

N66-28852# Rice Univ., Houston, Tex.
SIMPLIFIED APPROACH TO THE PROBLEM OF THE OPTIMUM TRANSVERSAL CONTOUR
Angelo Miele 1966 22 p refs
(Grant AF-AFOSR-828-63)
(AAR-19; AD-479072)

The problem of finding the transversal contour of a conical body of given length and base area so as to minimize the total drag in hypersonic flow is considered under the assumptions that the pressure distribution is Newtonian and the skin-friction coefficient is constant. Both the case of a slender body and that of a nonslender body are investigated, and a simple proof of the properties of the extremal arc is supplied within the frame of a special coordinate system. Specifically, the independent variable theta is proportional to the

base area associated with the angular interval O, theta and the dependent variable u is proportional to the base area per unit perimeter. Depending on the length, the base area, and the skin-friction coefficient, three solutions are possible: (1) circular arcs, (2) combinations of straight line segments tangent to a basic circle, and (3) combinations of circular arcs and straight line segments tangent to the circular arcs. For each solution, the base area per unit perimeter and the aerodynamic drag per unit base area or unit perimeter are constant along the external arc. Author (TAB)

N66-29067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL LIFT INTERFERENCE ON SWEPTBACK WINGS IN RECTANGULAR TEST SECTIONS WITH SLOTTED TOP AND BOTTOM WALLS

Ray H. Wright and Raymond L. Barger Washington, NASA, Jun. 1966 20 p refs

(NASA-TR-R-241) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A theory is presented for the boundary-induced upwash interference on a sweptback lifting wing mounted at the center of a rectangular wind-tunnel test section with slotted top and bottom walls and closed side walls. A sample calculation for a wing spanning 0.7 of the width of a square tunnel shows the spanwise variation in the interference characteristic of this type of test section. For this example, the wing sweep did not have a large effect on the interference. Author

N66-29127# Pisa Univ. (Italy). Inst. of Aeronautics.

AERODYNAMIC INTERACTION EFFECTS OF A SUPERSONIC AXISYMMETRIC JET EXHAUSTING BELOW A FLAT PLATE INTO A SUPERSONIC FREE STREAM Final Report

Enrico Pistolesi and Marino Marini May 1965 54 p refs

(Grant AF-EOAR-63-97)

(AD-631556) CFSTI: HC $3.00/MF $0.75

The interference effect in a supersonic stream between a supersonic jet and a flat plate near it is studied by means of the linearized theory. The characteristics of a supersonic axisymmetric jet issuing from a duct in a supersonic stream are first obtained. The effects of the flow around the jet on a flat plate disposed at some finite distance from the jet discharge section are studied, showing the difficulties of an exact calculation and the possibilities to obtain some approximate results. Author (TAB)

N66-29201# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

METHOD OF CALCULATING THREE-DIMENSIONAL SUPERSONIC GAS FLOWS AROUND BODIES

Z. D. Zapryanov and V. B. Minostsev 30 Sep. 1965 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 5, 1964 p 20-24 *Its* Transl.-1552

(Contract NOw-62-0604-c)

(TT-66-61110; AD-631630) CFSTI: HC $1.00/MF $0.50

The first section contains a description of the calculation of two-dimensional flows, the second of three-dimensional flows, and the third section contains the results of calculation of flow over a number of specific bodies. The method of characteristics is widely used to calculate supersonic regions of two-dimensional flows. TAB

N66-29209*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

EFFECT OF THICKNESS AND SWEEP ANGLE ON THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SLAB DELTA PLANFORMS AT A MACH NUMBER OF 20

Robert D. Witcofski and Don. C. Marcum, Jr. Washington, NASA, Jun. 1966 90 p refs

(NASA-TN-D-3459) CFSTI: HC $3.00/MF $0.75 CSCL 01A

An investigation was conducted at a free-stream Mach number of approximately 20 to determine the effects of sweep angle and thickness on the longitudinal aerodynamic characteristics of basic delta planforms. The sweep angles investigated were 45°, 60°, 70°, 80°, 85°, and 90°, and the ratio of thickness to root-chord length varied from 0 to 0.3. Reynolds number based on wing length varied from 1.4×10^6 to 6.6×10^6 and the angle-of-attack range was approximately from 0° to 30°. Experimental estimates of the optimum sweep angles for obtaining maximum lift-drag ratio for a given thickness ratio were made. Also obtained were experimental curves for determining the slopes of the normal-force curves and lift curves at zero angle of attack. Maximum lift-drag ratio exhibited a nearly linear decay as thickness ratio and volumetric coefficient were logarithmically increased. Angle of attack at maximum lift-drag ratio increased nearly exponentially with thickness ratio. Increasing wing thickness from zero shifted the center of pressure forward from the 2/3-root-chord point. Newtonian impact theory and a modified Newtonian impact theory plus skin-friction calculations were generally adequate for predicting trends only. Author

N66-29210*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

EFFECT OF BODY NOSE BLUNTING, CONTROL PLANFORM AREA, AND LEADING-EDGE BLUNTNESS ON AERODYNAMIC CONTROL OF A 5° SEMIVERTEX CONE AT MACH NUMBER 6.9

Jim A. Penland Washington, NASA, Jun. 1966 68 p refs

(NASA-TN-D-3460) CFSTI: HC $3.00/MF $0.75 CSCL 01A

An investigation was conducted to determine the longitudinal, lateral, and directional control characteristics of a conical configuration with a 5° semi-vertex angle and cruciform delta planform control surfaces. The investigation was conducted at a Mach number of 6.9 and a Reynolds number of 2.8×10^6 based on model length. The configuration variables included nose bluntness, control leading-edge bluntness, and control planform area. For all configurations the longitudinal control effectiveness remained constant or improved with angle of attack. The blunting of control leading edges decreased their effectiveness. An increase in body nose bluntness decreased control effectiveness at low angles of attack, but at angles of attack above 10° little variation with nose bluntness was noted. An increase in control planform area, leading-edge bluntness, or body nose bluntness increased trim drag and decreased trim-lift range and trim lift-drag ratio. The deflection of vertical surfaces for yaw control resulted in not only the desired yaw but also an excessive rolling moment at angle of attack. Differential deflection of either horizontal or vertical surfaces provided roll control; however, a considerable yawing moment accompanied the control deflections at angle of attack. The calculated values determined by shock expansion theory of pitch, yaw, and roll control characteristics at an angle of attack of 0° were slightly in excess of measured values. Author

N66-29211*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

A THEORETICAL ANALYSIS OF THE DYNAMIC LATERAL STABILITY AND CONTROL OF A PARAWING VEHICLE

Joseph R. Chambers and Peter C. Boisseau Washington, NASA, Jun. 1966 47 p refs
(NASA-TN-D-3461) CFSTI: HC $2.00/MF $0.50 CSCL 01A

A theoretical analysis was made of the dynamic lateral stability and control of parawing vehicles. The analysis is treated mainly in terms of the effects of vertical center-of-gravity position. Increasing the vertical distance between the payload and parawing decreased damping of the roll-subsidence mode and increased damping of the spiral mode. It also caused an increase in the damping and period of the lateral oscillation and a reduction in the ratio of roll to sideslip. The stability derivative C_{n_p} (yawing-moment coefficient due to rolling angular velocity) and the mass parameter K_{xz} (nondimensional product-of-inertia parameter) were the principal factors influencing the damping of the lateral oscillation as the center-of-gravity location was lowered with respect to the parawing. There was little effect of vertical center-of-gravity location on the initial roll response to wing bank control but as the motion progressed, the configurations having the lower center-of-gravity locations displayed the greater roll response. The effects of vertical center-of-gravity location on the mass distribution of the system produced significant changes in the initial yawing motion following the application of wing bank control. The large nose-down inclination of the principal axis of least inertia caused by lowering the center-of-gravity position relative to the parawing tended to reduce the initial adverse yawing motion of the system. Author

N66-29215*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF SURFACE PITOTS FOR MEASURING TURBULENT SKIN FRICTION AT SUPERSONIC MACH NUMBERS—ADIABATIC WALL
Edward J. Hopkins and Earl R. Keener Washington, NASA, Jul. 1966 107 p refs
(NASA-TN-D-3478) CFSTI: HC $4.00/MF $0.75 CSCL 01A

Two types of surface pitot tubes were investigated for measuring local turbulent skin friction at supersonic speeds. These tubes consisted of a circular tube, called a Preston tube, and a two-dimensional blade over a static orifice, hereinafter called a Stanton tube. They were calibrated in air against the measured skin friction throughout a Mach number range from 2.4 to 3.4 and a Reynolds number range from about 16 to 100 million. The boundary layer in which the surface tubes were mounted varied in thickness from about 5 to 7 inches, and the wall temperature was close to adiabatic. The surface pitot data are presented on the basis of several calibration factors that have been used in the past and on the basis of a newly developed calibration factor. In addition to the surface tube calibrations, some existing local skin-friction results, measured for turbulent boundary layers on adiabatic flat plates, are compared with theoretical values on the basis of equal momentum thickness Reynolds numbers throughout a Mach number range from 0.06 to 6.7. Author

N66-29227# David Taylor Model Basin, Washington, D. C. Aerodynamics Lab.
STATIC TESTS ON TEN RELATED CIRCULAR SHROUD INLETS
Arthur E. Johnson and William B. Maguire Mar. 1966 26 p ref *Its* Aero Rept.-1104
(DTMB-2171; AD-632488) CFSTI: HC $1.00/MF $0.50

Static tests were made on a series of circular duct inlets designed to have minimum lip thickness. Measured surface static pressures are in excellent agreement with theoretical predictions. The minimum lip thickness of test inlets that did not have separated flow was 0.069, expressed as the ratio of lip thickness to internal duct diameter. Results indicate that flow will separate from the lip if the predicted lip surface pressure (suction) coefficient is greater than 6.0, but will not separate if the pressure coefficient is less than 4.5. Author (TAB)

N66-29257# Mississippi State Univ., State College. Dept. of Aerophysics.
AN INVESTIGATION OF END PLATES TO REDUCE THE DRAG OF PLANAR WINGS
Sean C. Roberts Fort Eustis, Va., Army Aviation Materiel Labs., Jan. 1966 67 p refs
(Contract DA-44-177-AMC-892(T))
(USAAVLABS-TR-65-79; AD-632520) CFSTI: HC $3.00/MF $0.75

An analytical and experimental study has been performed to determine the optimum design of end plates which have minimum parasite drag and maximum effect on induced drag. Experiments were performed in a smoke tunnel and at full-scale Reynolds numbers on a modified PA-18 Super Cub aircraft. Flat end plates were found to be relatively ineffectual as a means of reducing the induced drag of aircraft, and the undesirable effect of large flat plates on the directional stability of an aircraft was an important effect to be considered. Cambered wing tip plates are worthy of further consideration, since a 15 percent decrease of induced drag with a 12 percent increase of L/D ratio was obtained from the configurations tested. Author (TAB)

N66-29294*# Washington Univ., Seattle. Dept. of Aeronautical Engineering.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF WIND TUNNEL GEOMETRY, EMPHASIZING FACTORS PERTINENT TO V/STOL VEHICLES TESTING Progress Report No. 3, Sep. 16, 1965–Mar. 15, 1966
R. G. Joppa 1 Jun. 1966 9 p
(Grant NGR-48-002-010)
(NASA-CR-75822) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Several problems connected with wind tunnel testing of V/STOL models are discussed. The effects of testing near either end of the two-test section wind tunnel were measured to show the effects of the converging flow fields predicted in the analytical work. Testing was conducted at higher advance ratios to avoid downwash regions and the conditions in which airspeed measurements are sensitive and suspect. Pitching moments and lift were measured on a powered rigid rotor at the centerline of the test section and at a station near the downstream contraction; the pitching moment slope showed a 20% increase in stability, clearly demonstrating that the converging flow field exists ahead of the contraction. The analysis of internal flow fields in a two-test section tunnel by the vortex ring method was extended to make it more suitable for calculating flow through an open circuit wind tunnel. Finally, the wake trajectory in a closed wind tunnel was calculated. It was confirmed that the wake vortex would change its position significantly with respect to its free air position. L.E.W.

N66-29374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECENT RESEARCH RESULTS IN THE AERODYNAMICS OF SUPERSONIC VEHICLES

A. Warner Robins, Odell A. Morris, and Roy V. Harris, Jr. [1965] 20 p refs Presented at the AIAA/RAeS/JSASS Design and Technol. Meeting, Los Angeles, 15–18 Nov. 1965 (NASA-TM-X-56865) CFSTI: HC $1.00/MF $0.50 CSCL 01A

The continuing aerodynamic-research effort aimed at improving the design of supersonic-cruise vehicles has recently produced some significant results. Research by both government and industry has provided, in addition to a better understanding of the design problem itself, some new and very useful design tools and concepts. Some of the advantages of these methods in the treatment of wave drag and drag due to lift are briefly discussed. Also presented are some new considerations of aerodynamic interference and its effect on the aerodynamic efficiency of the trimmed vehicle. An illustrative example of the application of these design tools and concepts to the aerodynamic design of a supersonic-cruise vehicle (SCAT 15-F) is made. A parallel analytic and experimental buildup of the vehicle is presented including treatment of the symmetric (flat camber-plane), the warped, and the warped-and-reflexed versions of the configuration. The potential of the new techniques is demonstrated by the good agreement between experiment and theory and by the high level of vehicle performance. Author

N66-29389*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SIMULATOR STUDY OF T-TAIL AIRCRAFT IN DEEP STALL CONDITIONS

Lindsay J. Lina and Martin T. Moul [1965] 15 p refs Presented at the AIAA/RAeS/JSASS Aircraft Design and Technol. Meeting, Los Angeles, 15–18 Nov. 1965

(NASA-TM-X-56806) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Fixed base simulations were made to investigate the tendency of T-tail aircraft to pitch up into a deep stall from which recovery is difficult. Factors considered in deep stall recovery included pitching moment versus angle of attack, center of gravity location, elevator and stabilizer effectiveness in stall, thrust moment, pitch damping, and inertia in pitch. Aerodynamic characteristics used in the simulation are illustrated, and the lift, drag, elevator effectiveness, and pitch damping were plotted as functions of angle of attack. The investigation consisted of deliberately executed deep stall entries on the simulator followed by recovery attempts. Pilot performance of stall recovery is illustrated for first encounter and after practice and for configurations with constant damping and variation in damping. A configuration index ΔC_m was evaluated, and results revealed the following in relation to pilot recovery: recovery performance for configurations with small negative values of ΔC_m was poor as large losses in altitude were experienced; damping in pitch is important in determining deep stall recovery capability; and in some configurations lateral instability control may be an overriding task. L.E.W.

N66-29417*# National Aeronautics and Space Administration, Washington, D. C.

HYPERSONIC FLOW AROUND A CIRCULAR CONE AT AN ANGLE OF ATTACK [GIPERZVUKOVOYE OBTEKANIYE KRYGLOGO KONUSA POD UGLOM ATAKI]

Ya. G. Sapunkov Mar. 1963 7 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (USSR), no. 1, 1963 p 190–192 (NASA-TT-F-8414) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A first approximate solution is obtained for the problem of hypersonic gas flow around a circular cone. The solution is obtained by the Cheng (1962) method of expansion of small parameters; however, in contrast to the Cheng solution, the expressions obtained for the density, shape of the shock wave, circular velocity, and pressure do not contain the terms with n (1+k). However, the expression obtained for the entropy does contain this term, whereas Cheng's expression does not. The suggestion is made that the error in Cheng's work occurred because of incorrectly computed entropy. The results obtained by the first approximation for the case where $\beta=0$ agree with the results reported by Chernyy (1959). M.P.G.

N66-29461*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va.

PERFORMANCE, STABILITY, AND CONTROL CHARACTERISTICS AT TRANSONIC SPEEDS OF THREE V/STOL AIRPLANE CONFIGURATIONS WITH WINGS OF VARIABLE SWEEP

Arvo A. Luoma and William J. Alford, Jr. Washington, NASA, Oct. 1960 223 p refs

(NASA-TM-X-321) CFSTI: HC $6.00/MF $1.25 CSCL 01A (Declassified)

An investigation of the performance, longitudinal stability and control, and lateral stability of three V/STOL variable-wing-sweep airplane configurations with wing outboard panels swept 25°, 50°, and 75° was made in an 8-foot transonic pressure tunnel. Data were obtained for an angle-of-attack range at Mach numbers from 0.60 to 1.30. The general effects of wing sweep and Mach number on the aerodynamic characteristics of the three models investigated were similar and show the same trends as have been reported for other configurations employing a similar variable-sweep wing. The maximum lift-drag ratios are somewhat lower than those for contemporary configurations which do not have V/STOL capabilities. The aerodynamic-center shift for both wing sweep angle and Mach number is somewhat improved over that for previous configurations and amounts to approximately 13 percent of the mean aerodynamic chord for a change from 25° of sweep at a Mach number of 0.60 to 75° of sweep for Mach numbers near 2.0. For 25° of sweepback, the lowest sweep angle investigated, longitudinal instability occurs at moderate lift coefficients. Although the models were directionally stable for low and moderate angles of attack, they became unstable in the neighborhood of 10° to 12°. Author

N66-29466*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF A V/STOL AIRPLANE CONFIGURATION WITH A FIXED DELTA WING HAVING AUXILIARY VARIABLE-SWEEP OUTBOARD PANELS

Arvo A. Luoma Washington, NASA, Dec. 1961 86 p refs

(NASA-TM-X-661) CFSTI: HC $3.00/MF $0.75 CSCL 01A (Declassified)

An investigation of the longitudinal aerodynamic characteristics of several versions of a V/STOL airplane configuration which employed a fixed delta wing of low aspect ratio with auxiliary variable-sweep outboard panels was made in the Langley 8-foot transonic pressure tunnel at Mach numbers from 0.60 to 1.20. Unsatisfactory subsonic minimum drag characteristics exhibited by the original version of the V/STOL airplane configuration and which appeared to be associated with interference effects from the ducting were eliminated by configuration revisions. The longitudinal stability of the retracted-wing configurations was stable and that of the extended-wing configurations was essentially neutral. The change in longitudinal stability from that for the extended-wing

configuration at a Mach number of 0.60 to that for the retracted-wing configuration at a Mach number of 1.20 corresponded to a rearward movement of the aerodynamic center of 13 percent of the reference length for the original version of the V/STOL airplane configuration and 8.5 percent of the reference length for the revised version. Author

N66-29467*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF TWO V/STOL AIRPLANE CONFIGURATIONS WITH SKEWED AND VARIABLE-SWEPT WINGS
Arvo A. Louma Washington, NASA, Apr. 1961 106 p refs
(NASA-TM-X-527) CFSTI: HC $4.00/MF $0.75 CSCL 01A
(Declassified)

An investigation of the longitudinal aerodynamic characteristics of two versions of a V/STOL airplane design was made in the Langley 8-foot transonic pressure tunnel at Mach numbers from 0.60 to 1.20. A skewed wing and a variable-sweep wing were tested on the models. Wing skew angles of 0°, 30°, 60°, and 90° and wing outboard panels swept 25°, 75°, and 108° with respect to the leading edge were investigated. The tests were made at angles of attack from about −2° to 11°. Increasing the skew angle to high values produced a positive trim change. A larger horizontal tail substantially reduced nonlinearities evident in the variation of pitching moment with lift for the configuration with the highly skewed wings. The effect of wing sweep and Mach number on the longitudinal aerdynamic characteristics are generally the same as that reported for other V/STOL configurations employing a similar variable-sweep wing. Author

N66-29495# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
NUMERICAL METHODS FOR THE DESIGN OF VARIABLE MACH NUMBER LAVAL NOZZLES
G. Y. Nieuwland Dec. 1964 24 p refs Submitted for Publication
(NLR-TR-T.124) CFSTI: HC $1.00/MF $0.50

Laval nozzle flows are defined by a Cauchy problem. Initial value perturbations, using the PLK-technique, and boundary perturbations in the supersonic region are considered. Applications to practical design problems are discussed. Author

N66-29535# Aeronautical Research Council (Gt. Brit.)
PRESSURE DISTRIBUTION MEASUREMENTS ON A SERIES OF SLENDER DELTA BODY SHAPES AT MACH NUMBERS OF 6.85 AND 8.60
D. H. Peckham 1965 36 p refs Supersedes RAE-TN-AERO-2952; ARC-25966
(ARC-CP-791; RAE-TN-AERO-2952; ARC-25966) CFSTI: HC $2.00/MF $0.50

Results are given of a wind tunnel program made to study the pressure distributions, mainly on the windward surfaces, of a series of simple body shapes, over a range of angles of incidence up to 29 degrees. It was found that the comparison of experimental pressure distributions with values calculated from various inviscid flow theories and approximations, was complicated by the non-independence of upper and lower surface flow fields, and by boundary-layer-displacement effects. From the few measurements made of upper surface pressure distributions, quite large differences in behavior were observed between Mach numbers of 6.85 and 8.60. Recommendations are made in regard to future experiments. Author

N66-29712*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF THE DYNAMIC LATERAL STABILITY AND CONTROL OF A PARAWING VEHICLE
Joseph R. Chambers (M.S. Thesis—Va. Polytech. Inst.) May 1966 86 p refs
(NASA-TM-X-57693) CFSTI: HC $3.00/MF $0.75 CSCL 01A

Parawing vehicles may have unusual values of many of the mass and aerodynamic factors affecting dynamic lateral stability and control. These unusual characteristics are due in large part to the fact that the center of gravity of parawing vehicles is located far below the parawing, whereas conventional aircraft usually have the vertical center-of-gravity location near the plane of the wings. The present thesis is an analytical investigation of the dynamic lateral stability and control of a typical parawing vehicle. The analysis was made using three-degree-of-freedom, rigid body equations of motion. Stability derivatives used in the calculations were obtained from static and dynamic force tests of a parawing model with rigid leading-edge and keel members. The analysis is treated mainly in terms of the effects of vertical center-of-gravity position, since this was found to be the most significant factor affecting the lateral stability and control of the hypothetical vehicle. Author

N66-29846# General Applied Science Labs., Inc., Westbury, N. Y.
WIND TUNNEL INVESTIGATION OF THE TURBULENT NEAR WAKE OF A CONE AT ANGLE OF ATTACK
A. J. Schlesinger and A. Martellucci Mar. 1966 61 p refs (Contract ARPA SD-149; ARPA Order 396)
(TR-581; AD-632536) CFSTI: HC $3.00/MF $0.75

Aerodynamic measurements were made in the turbulent near wake of 10° half angle circular cone at a 10° angle of attack. The experiments were conducted at Mach 6 with a stagnation pressure of 800 psi and a corresponding free stream unit Reynolds number of 14.4 million per foot. The Reynolds number was sufficiently large so that the boundary layer at the cone shoulder was turbulent. Detailed radial profiles of the total and static pressures along the meridian plane of symmetry in the supersonic regions of the wake at several axial stations are presented. In addition, the shape of the u=0 line in the meridian plane of symmetry was also obtained. Correlations are shown for nearwake data obtained for zero angle of attack. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-28566*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY TO DETERMINE EFFECTS OF APPLYING THRUST ON RECOVERY FROM INCIPIENT AND DEVELOPED SPINS FOR FOUR AIRPLANE CONFIGURATIONS

Sue B. Grafton Washington, NASA, Jun. 1966 49 p refs
(NASA-TN-D-3416) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An analytical study has been conducted to examine the effects of applying thrust along with optimum aerodynamic control surface deflections on the spin-recovery characteristics from both incipient and developed spins for four configurations considered as generally representative of modern airplanes. The results of this investigation indicate that the effects of thrust on spin recovery, either favorable or unfavorable, are generally small; however, they do indicate that applying thrust during a relatively nonoscillatory spin has a favorable effect on the number of spinning turns required for recovery. The magnitude of the improvement is not large but may be such that the use of a turbojet propulsion engine may aid recoveries, especially during the incipient phase of the spin. The use of thrust during attempted recoveries from fairly oscillatory spins indicates no consistent effects—that is, both favorable and unfavorable results have been obtained. Since the number of configurations investigated herein is too small to provide conclusive evidence and since there is a possibility of serious damage to jet engines due to inlet flow distoritions caused by the high angles of attack involved in a spin, the use of engine thrust as part of a spin-recovery technique should be carefully investigated for any airplane configuration in question before its use is recommended for that particular configuration. Author

N66-28665# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
FLIGHT EVALUATION OF VARIOUS PHUGOID DYNAMICS AND $1/T_{h1}$ VALUES FOR THE LANDING-APPROACH TASK
Final Report, Apr. 1964–Dec. 1965
Charles Chalk Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Feb., 1966 150 p refs
(Contract AF-33(615)-1253)
(TC-1921-F-4; AFFDL-TR-66-2, AD-480187)

Longitudinal handling qualities in the landing approach are studied. The T-33 variable stability and variable drag airplane was used in a flight program to evaluate various short period dynamics, phugoid dynamics, drag characteristics and elevator control authority levels. The first phase of the flight program was directed mainly at longitudinal short period dynamics, drag variation with angle of attack and elevator control authority. The second phase of the flight program was directed at phugoid dynamics, short period frequency, elevator control authority and drag characteristics. Drag variations with angle of attack, airspeed and elevator deflection were considered. Pilot ratings and comments are related to the airplane characteristics tests.
Author (TAB)

N66-28880# Royal Aircraft Establishment, Farnborough (England).
THE TECHNIQUE OF TOWING PARACHUTES BEHIND METEOR VT 150 WITH INSTRUMENTATION
G. G. Gale and K. James London, Min. of Aviation, May 1960 44 p refs
(RAE-TN-ME-317) CFSTI: HC $2.00/MF $0.50

This paper gives an account of the instrumentation, parachute container, and towing equipment used on a Meteor VT 150 and the modifications made on the original equipment to stream and tow parachutes of up to 7 feet in diameter, at heights up to 30,000 feet, and at speeds up to 280 knots. The method of preparing for streaming and towing, the aircraft performance and availability of excess thrust, the flight procedures and safety considerations, and clearance trials of the instrumentation and streaming equipment are also discussed. R.N.A.

N66-29183# Instrument Pilot Instructor School, Randolph AFB, Tex. Instrument Evaluation Branch.
OPERATIONAL TEST AND EVALUATION OF UNFILTERED WHITE LIGHTED INSTRUMENTS
Jan. 1966 11 p
(AD-631633) CFSTI: HC $1.00/MF $0.50

The SAE Committee A-20 on aircraft lighting requested that the Air Force review the need for blue filtered white lighting because many manufacturers have had a difficult time meeting the present specifications. Nineteen pilots flew filtered and unfiltered panels in the T-38, and their preference was strongly in favor of the blue filtered white lighting. Accordingly, it is recommended that the blue filter be retained.
Author (TAB)

N66-29218*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
LONGITUDINAL AND LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE, V/STOL MODEL WITH FOUR TILTING DUCTED FANS ARRANGED IN A DUAL TANDEM CONFIGURATION
Demo J. Giulianetti, James C. Biggers, and Ralph L. Maki Washington, NASA, Jun. 1966 61 p refs
(NASA-TN-D-3490) CFSTI: HC $3.00/MF $0.75 CSCL 01A

Differential fore–aft duct exit vane deflection and differential fore–aft thrust were effective for pitching-moment trim at the low and high duct incidences, respectively. Proper phasing of these controls would be necessary for longitudinal trim in the intermediate duct incidence range from 40° to 70° where the trim requirements reached a maximum. Thrust vectoring by the use of differential fore–aft duct incidence was effective in reducing these trim requirements. Author

N66-29256# Stevens Inst. of Tech., Hoboken, N. J. Davidson Lab.
THE EFFECT OF CAMBER ON THE NEAR-SURFACE FORCE, CENTER-OF-PRESSURE, AND VERTICAL STABILITY CHARACTERISTICS OF A RECTANGULAR-PLANFORM HYDROSKI
R. L. Van Dyck Dec. 1965 23 p refs
(Contract N600(19)62908)
(Rept.-1102; AD-632398) CFSTI: HC $1.00/MF $0.50

The hydrodynamic force characteristics of a cambered rectangular planform, 15° deadrise hydroski are shown to be similar to those of an equivalent uncambered ski with the exceptions that, for a cambered ski: (1) the zero lift angle is shifted to lower angle of attack for the same wetted area and aspect ratio and (2) the center of pressure is shifted aft. Comparison at the same draft—or wetted area and aspect ratio—show similar submerged lift-drag ratios for both cambered and uncambered skis in the range of trim angles tested. The region of pre-emergence vertical instability is shown to be caused by the loss in lift as a hydroski runs in the range of drafts just below the planing boundary down to drafts sufficiently deep to preclude ventilation and surface effects, when a ski can run stable fully-wetted with approximately double the planing lift. Increased forward acceleration at unporting was found to shift the pre-emergence instability range to higher speeds and to reduce the time interval spent in this unstable region. Author (TAB)

N66-29326*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ATMOSPHERIC EFFECTS ON SONIC-BOOM SIGNATURES

Domenic J. Maglieri and Harvey H. Hubbard [1965] 12 p refs Presented at the 5th Intern. Congr. on Acoustics, Liege, 7–14 Sep. 1965
(NASA-TM-X-56436) CFSTI: HC $1.00/MF $0.50 CSCL 20A

Data from flight experiments illustrate the nature of various atmospheric effects on sonic-boom ground-pressure signatures. Atmospheric refraction, grazing incidence wave impingement, and turbulence interaction phenomena are discussed along with their significance regarding the community response problem of sonic booms. Author

N66-29403*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUMMARY OF HINGELESS-ROTOR STRUCTURAL LOADS AND DYNAMICS RESEARCH
John F. Ward [1965] 40 p refs Presented at Symp. on the Noise and Loading Actions on Helicopter V/STOL Aircraft and Ground Effect Machines, Southampton Univ., England, 30 Aug.–3 Sep. 1965
(NASA-TM-X-56726) CFSTI: HC $2.00/MF $0.50 CSCL 20K

This paper presents a summary of research programs dealing with helicopter hingeless-rotor structural loads and dynamics. The programs include (1) flight investigations, (2) dynamic-model wind-tunnel tests, and (3) derivation and substantiation of simplified analytical techniques for the prediction of critical structural loads in maneuver flight. Comparison of measured data and analytical results will be utilized in order to clarify the trends observed in the flight and wind-tunnel results. Author

N66-29468*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
PRELIMINARY RESULTS OF AERODYNAMIC HEATING STUDIES ON THE X-15 AIRPLANE
Richard D. Banner, Albert E. Kuhl, and Robert D. Quinn Washington, NASA, Mar. 1962 22 p refs
(NASA-TM-X-638) CFSTI: HC $1.00/MF $0.50 CSCL 01C (Declassified)

The results of the preliminary flight heat-transfer studies on the X-15 airplane are presented, together with a discussion of the manner in which the data have been obtained, a comparison of measured and calculated turbulent heat-transfer coefficients, a correlation of the model test results and the flight results for turbulent heat transfer, some information on boundary-layer transition, and a comparison of measured and calculated skin temperatures at several locations on the airplane. Author

N66-29483*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS OF APPROACH DURING POOR VISIBILITY [PROBLEMES DE L'APPROCHE PAR MAUVAISE VISIBILITE]
M. J. Gremillet Feb. 1963 9 p refs Transl. into ENGLISH of a French paper presented at the Agard Avionics Panel Meeting, Istanbul, 3–8 Oct. 1960
(NASA-TT-F-8369) CFSTI: HC $1.00/MF $0.50 CSCL 01B

A description of the Instrument Landing System (ILS) and its disadvantages are presented. A major fault of the ILS was interferences which lead to spurious axes. The goal reached by the General Wireless Company System (CSF) is the definition of a glide axis similar to that of the ILS system, with greater azimuthal plane precision and without the possibility of interference troubles. A description of the CSF system is given. Performance of the apparatus is described. Tests are presently in progress, and the principles developed by the Blind Landing Experimental Unit (BLEU) are being applied. The installation presently being tested dates back to 1953 and has worked in various locations without any serious trouble for more than 2500 hours. The whole facility comprises: (1) a trailer housing the emitter, the modulator, the system which divides the power fed to the four antennas, and the control instruments; (2) two parabolas for transmitting the lobes whose grouping defines the azimuth plane going through the runway axis; and (3) a double-excitation, parabolic cheese antenna at present attached to the rear of the trailer, transmitting the two lobes whose grouping defines the site planes. A detailed description of the transmission equipment, antennas, and airplane receivers is given. N.E.A.

N66-29550# Aviation Safety Engineering and Research, Phoenix, Ariz.
FULL-SCALE DYNAMIC CRASH TEST OF A LOCKHEED CONSTELLATION MODEL 1649 AIRCRAFT
W. H. Reed, S. H. Robertson, L. W. T. Weinberg, and L. H. Tyndall Oct. 1965 243 p
(Contract FA-WA-4569)
(FAA-ADS-38)

Ground crash testing was conducted on a large transport aircraft to obtain crash environment data for application to increased passenger survival and fire hazard reduction. Details are given on the instrumentation, and experimental equipment which included: military crew and commercial passenger seats, cargo restraint systems, radioactive material containers, a military litter system, and emergency lighting apparatus. The aircraft was accelerated under its own power by remote control at a velocity of 112 knots for 4000 feet, and was guided into sequential crash barriers with a monorail nose gear guidance system. It was concluded: (1) A realistic crash environment was produced, and experimental results valid. (2) Damage from the wing fuel tanks, which were ripped open by the wing barriers allowing simulated fuel to spill out in a heavy mist during the crash sequence, will be similar to that obtained in this test and will surround the aircraft, both while it is in motion and after it comes to rest. (3) The ignition potential of reciprocating engines is such that any similar release of either fuel or oil during a crash may be expected to result in an immediate fire. R.Ll.

N66-29728*# National Aeronautics and Space Administration, Washington, D. C.
FLIGHT HANDLING QUALITY PROBLEMS POSED BY SWEPT-WING TRANSPORT PLANES WITHOUT TAIL UNITS [QUELQUES PROBLEMES DE QUALITES DE VOL POSES PAR LES AVIONS DE TRANSPORT A AILE ELANCEE SANS EMPENNAGE]
P. Lecomte and E. Fage Jun. 1966 69 p refs Transl. into ENGLISH of a French paper presented at the 38th Meeting of the Flight Mech. Group of AGARD
(NASA-TT-F-10204) CFSTI: HC $3.00/MF $0.75 CSCL 01C

A new generation of swept wing, tail-less, and somewhat heavy planes is being born. These airplanes have many new features, being different from both delta winged warplanes and moderately swept wing transport planes. Some of these unusual features are analyzed from the viewpoint of the pilot's numerous tasks, and the applicability of some classic or new criteria is studied. A somewhat wide scanning of the possible characteristics is made concerning the lateral flight qualities.

Emphasis is put into the special low velocity type of behavior, in connection with the longitudinal flight qualities. It is concluded that flight qualities, while being different from those of their predecessors, compare favorably with them. Author

N66-29808# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF AN AUTOMATIC AIRSPEED CONTROL SYSTEM FOR THE KC-135APPROACH AND LANDING SYSTEMS
Eugene Royce Sullivan (M.S. Thesis) Jun. 1965 140 p refs
(GGC/EE/65-15; AD-619971) CFSTI: HC $4.00/MF $1.00

The purpose of the study was to investigate the design of an automatic airspeed control system and its effect on the pitch handling characteristics of the KC-135 when used during landing approaches. The longitudinal equations-of motion for the KC-135 and the pitch channel of the Bendix PB-20D autopilot were simulated. Three configurations of an airspeed control system were designed, using root locus techniques, which were added to the simulation and their response tested. Performance was satisfactory for two of the configurations: one for a manually flown aircraft, and one for an automatically flown aircraft. The study revealed a difference in the airspeed control system design requirements for a manually and an automatically flown aircraft. Also shown was that an airspeed control system with a response rapid enough to control system with a response rapid enough to control the airspeed satisfactorily during landing approaches will cause several reversals of the pitch trim of the aircraft caused by the thrust changes and results in a deterioration of the pitch handling characteristic of the aircraft. Author (TAB)

N66-29817# Naval Missile Center, Point Mugu, Calif.
LOW-ALTITUDE-FLIGHT MEASUREMENT POD (SANDUSTER): POD MEASURES AND RECORDS CHANGES IN AIRCRAFT ALTITUDE, ATTITUDE, AIRSPEED, AND VERTICAL ACCELERATION
Z. H. Blankers 12 Aug. 1965 16 p
(NMC-TM-65-41; AD-619911) CFSTI: HC $1.00/MF $0.50

The SANDUSTER program required a pod instrumented to measure changes in aircraft altitude, attitude, airspeed, and vertical acceleration with respect to time during low-altitude flight. The report describes the pod and its operation. Accuracies of the measurements are as follows: Altitude: Radar altimeter, Differential pressure transducer, ±5% of servo setting, and ±100 feet at flight altitudes below 2,000 feet; Airspeed, ±20 knots; Yaw, pitch, and roll rate, ±1° per second; and Vertical acceleration, ±5%. Measurement accuracy and reliability could be improved by: (1) replacing the existing radar altimeter with a more modern version, and (2) replacing the airspeed and altitude measurement transducers with more modern versions. The use of batteries would make the power system independent of the aircraft carrying the pod. Author (TAB)

N66-29857# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany) Institut für Flugmechanik.
PARACHUTE CANOPIES DURING INFLATION Final Report, Apr. 1963–Apr. 1965
H.-D. Melzig and P. K. Schmidt Sep. 1965 137 p
(Contract AF 61(052)-681)
(AD-631777) CFSTI: HC $4.00/MF $1.00

An experimental investigation and correlative analysis were conducted to determine the pressure distribution over the surface of parachute canopies during the period of inflation for the infinite mass case and to correlate pressure coefficients with inflating canopy shapes. Parachute canopy models of Circular Flat, 10% Extended Skirt, Ringslot, and Ribbon designs were tested under infinite mass conditions in a 9×12 ft low speed wind tunnel. External and internal pressure values were measured at various locations over the surface of the model canopies throughout the period of inflation, and generalized canopy profile shapes were obtained by means of photographic analysis. Pressure coefficients derived for the steady state (fully open canopy) are quite comparable to the results of previous measurements. Peak pressure values during the unsteady period of inflation were found to be up to 5 times as great as steady state values. The relationships between the pressure distribution and time for each of the canopy models deployed at free-stream velocities between 70 and 160 ft/sec are presented in detail and correlated with changing canopy shape. A complete shape analysis is made and a mathematical model is proposed. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-28417*# Princeton Research and Development Co., N. J.
A THEORETICAL AND EXPERIMENTAL STUDY OF RADIATION DAMAGE IN DRIFT-FIELD SOLAR CELLS Annual Report
J. A. Baicker 10 May 1966 47 p refs
(Contract NAS5-9580)
(NASA-CR-75688) CFSTI: HC $2.00/MF $0.50 CSCL 10A

This report describes the results of a theoretical and experimental study of drift field solar cells. The objective of the program was a general comparison of drift field cells with conventional solar cells, and in particular to understand and to predict the radiation damage behavior of drift field cells. The work which is reported here concentrates on two specific investigations: the current-voltage relationships in drift field cells compared with conventional cells, and the spectral response of the two types of cell. In both phases of the program detailed measurements were carried out at various sample temperatures, and in normal and irradiated cells. The temperatures were in the range from room temperature down to 77°K, and the irradiations were with 1 MeV electrons and 3 MeV protons. The results of the investigations provide clear indications of the reasons for the failure of drift field cells to outlast conventional cells when they are operated in a radiation environment. Author

N66-28509# Naval Research Lab., Washington, D. C. Radiation Div.
THERMAL ANNEALING OF IRRADIATED n-ON-p SILICON SOLAR CELLS
Regina V. Tauke *In Its* Rept. of NRL Progr. Dec. 1965 p 1-6 refs (See N66-28508 16-23) CFSTI: $1.25

Resistivity (ρ) changes caused by thermal annealing of irradiated n-on-p silicon solar cells are reflected in open

circuit voltage (V_{oc}) changes. At fluxes of 10^{17} electrons/cm^2, V_{oc} changes attributable to ρ changes are comparable in magnitude to changes caused by decreased lifetime (τ). Open-circuit voltage is insensitive to small changes in ρ. At a flux of 10^{16} electrons/cm^2, nearly all the change in V_{oc} is a result of decreased τ. A large dip in V_{oc} is observed in unirradiated and irradiated cells annealed at 400° C to 450° C. Author

N66-28525*# Case Inst. of Tech., Cleveland, Ohio.
EXPERIMENTAL SCALING STUDY OF FLUID AMPLIFIER ELEMENTS Final Report
Isaac Greber, Charles Taft, and Joseph Abler 31 Mar. 1966 48 p refs
(Contract NAS8-11267)
(NASA-CR-75668) CFSTI: HC $2.00/MF $0.50 CSCL 13G

Scaling parameters of three fluid amplifier elements are investigated experimentally. The elements are a bistable device, a boundary layer control device, and a vortex device. Appropriate parameters for presentation of the experimental data are determined by dimensional analysis. The large number of non-dimensional parameters is considerably reduced by physical reasoning to produce relatively simple correlation schemes. Despite the major geometrical differences among the elements, the simplified correlation schemes are remarkably similar. Experimental data are grouped according to the simplified correlation schemes. The experiments show that there exist ranges of operation in which performance varies only weakly with Reynolds number; and that there exist ranges in which the performance parameters appear only in combination, which results in important additional simplification of the experimental correlations. Ranges in which the simplified correlations are expected to break down, and use of the scaling ideas for other elements, are discussed. Author

N66-28738# Naval Ordnance Lab., Corona, Calif.
MINIATURIZATION OF OUT-OF-LINE EXPLOSIVE SAFETY SYSTEMS. A STUDY OF PROBLEMS RELATING TO DESIGN, FABRICATION, AND QUALITY CONTROL
Robert H. Stresau (Stresau (R.) Lab.) 15 Apr. 1966 27 p refs
(Contract N123(62738)31089A)
(NAVWEPS-8840; AD-481280)

Problems relating to the miniaturization of missile fuze explosive systems include the ambiguity of safety policy and the inhibiting effect of standardization on making innovations. Several electric initiator designs adapted to miniaturization are discussed. Designs for detonators and other components are considered, as well as loading, explosive preparations, quality control, and an evaluation program. Currently, substantial miniaturization is feasible, but appreciable effort is needed to develop miniaturized systems, quality control, and evaluation procedures that will assure safety and reliability. Author (TAB)

N66-28763*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
SPACE VEHICLE CONTROL SYSTEMS
Wallace E. Vander Velde *In its* Space Navigation Guidance and Control, Vol. 2 Jun. 1965 65 p refs (See N66-28759 16-21) CFSTI: HC $6.00/MF $1.50

The specific problems of vehicle attitude control under rocket-powered flight, free-fall coast, and atmospheric glide conditions are presented and various solutions are discussed. Powered flight control is considered primarily a problem in attitude control, and the gimbaled engine and fixed engine methods of generating the required control moments are examined. The factors involved in acceleration vector control are also considered. The requirements for attitude control during coasting flight include sun pointing, antenna pointing, orienting for navigation sights, and orienting for thrusts. Attitude references usually used during midcourse coasting flights are sun and star lines during quiescent periods and inertial reference during reorientations; sources of control moments are reaction jets or momentum exchange systems. High speed atmospheric flight requires control over the flight path as well as attitude control of the vehicle itself. Emphasis is focused on the reentry and landing control problems. The various phases of the reentry trajectory are depicted and discussed. L.E.W.

N66-28808*# Battelle Memorial Inst., Columbus, Ohio.
AN ADVANCED THERMOELECTRIC COMPONENT DEVELOPMENT PROGRAM Final Summary Report
18 Feb. 1966 167 p refs
(Contract NAS5-9160)
(NASA-CR-75802) CFSTI: HC $5.00/MF $1.00 CSCL 10A

The tasks in the program are segregated by diverse technologies and are reported separately. Under Task I, Computer Code Modification, a new program based upon the extension and generalization of an existing program has been written, debugged, and operated. The program in its present form is capable of analyzing thermoelectric generators for space use where the design under investigation uses the static heat-transfer mode and geometries based upon right-cylindrical configurations. Work performed under Task II, High-Temperature Segmented Thermoelectric Development, progressed to the point where a series of fabrication schemes and segmented element configurations have been examined. Fundamental studies of thermoelectric materials properties, transition member bonding between SiGe and PbTe materials, hot shoe bonding to GeSi material, and PbTe-segment fabrication were performed to support the selection of the fabrication schemes and segmented element configurations. Under Task III, Development of a Thermal Insulation and Support Structure, test specimens composed of multilayered webs and foils and representing variances in web and foil thickness and web spacing have been fabricated and tested. A test program consisting of shear and mechanical strength and heat-transfer measurements was performed. The experimental data were reduced and compared to analytical predictions. A parametric display of the parameters of interest, weight, heat transfer, and strength was made. Author

N66-28919# Hokkaido Univ., Sapporo (Japan). Faculty of Engineering.
ESTIMATION OF CHARACTERISTICS OF TWO BRANCHED FRANSIS TURBINES IN PARALLEL RUNNING
Mikio Arie, Sei-ichi Iida, Masayuki Mitani, and Teruo Yamazaki *In its* Bull. of the Fac. of Eng., No. 37 Jun. 1965 p 51-58 (See N66-28916 16-34) CFSTI: HC $3.00/MF $0.50

A new device for estimating the characteristics of two branched Fransis turbines in parallel running is proposed after the results of a field test. By regarding the guide vane stroke as a parameter, each operating condition of the two turbines in parallel running can be obtained with reference to the characteristics of single running to be measured separately. When the total output of the unit was almost equally divided into each turbine, the application of this method was simply performed even in the cases of partial-load operations. Author

N66-29082*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.

IMPROVED MAGNETIC COMPONENTS FOR STATIC INVERTERS AND CONVERTERS, PART 1 Eighth Quarterly Report, 31 Mar.–31 Aug. 1965

R. E. McVay [1965] 247 p

(Contract NAS3-2792)

(NASA-CR-54963; WAED-66.13E) CFSTI: HC $6.00/MF $1.50 CSCL 09A

All of the sine current screening CCFR and sine flux screening core loss tests have been completed. The square wave CCFR tests at 400, 800, 1600, and 3200 cps have been completed. The square wave a-c core loss and apparent power at 400, 800, 1600, and 3200 cps, on all the materials at room ambient temperature and −55°C have been obtained. The magnetic test results are shown in tables and curves. The CCFR calibration traces and test pictures are shown. The materials tested were magnetic field annealed 49%Co–2%V–29%Fe; doubly grain-oriented, silicon steel (with and without a magnetic anneal); single grain-oriented, silicon steel; square loop 79%Ni–4%Mo–17%Fe; and oriented 50%Ni–50%Fe.

Author

N66-29083*# Monsanto Research Corp., Everett, Mass. Boston Lab.

DEVELOPMENT OF THE DRY TAPE BATTERY CONCEPT Quarterly Report No. 3, 9 Dec. 1965–8 Mar. 1966

John S. Driscoll, Joseph J. Byrne, and David L. Williams 28 Apr. 1966 43 p refs

(Contract NAS3-7624)

(NASA-CR-54981; MRB5010Q3) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Expanded magnesium was found to be superior to perforated magnesium in $AlCl_3$–$MgCl_2$/ACL-85 static tests. The effect of the atmosphere on the active chlorine content of the cathode was found to be minor up to 72 hours exposure. The effect of a large number of variables on nonaqueous ACL discharge characteristics was determined. Conducting additives were introduced into the cathode mix. It was found that acetylene black can be partially replaced by graphite. This should reduce the final system electrolyte requirements. Electrolyte aging was found to severely affect ACL-70 decomposition in nonaqueous solution. The Li/$LiClO_4$(MF)/CuF_2 system showed voltage and cathode efficiencies approaching 3.0 volts and 70% respectively, at 0.05 amp/in.^{2}. The use of limited amounts of electrolyte in static, nonaqeous tests improved the cathode efficiencies in the Li/ACL-70 cell. This is attributed to a decrease in ACL-70 solubility and the resulting reduction of self-discharge effects. Short lengths (4 ft) of ACL-85 tape cathodes were prepared and evaluated dynamically. Author

N66-29084*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.

PROGRAM TO DEVELOP AN INORGANIC SEPARATOR FOR A HIGH TEMPERATURE SILVER–ZINC BATTERY Quarterly Progress Report, 29 Jan.–29 Apr. 1966

C. Berger, F. C. Arrance, and A. Himy May 1966 66 p refs

(Contract NAS3-7639)

(NASA-CR-54987; SM-48461-Q3) CFSTI: HC $3.00/MF $0.75 CSCL 10C

Test cells were operated successfully at 30 ma/cm^2 at 25° and 100°C. Although cells can be operated at current densities of 50 ma/cm^2 and higher, it was found that recharge rates are excessive due to the 1/2 to 1 hour test regimes. The long life characteristics of the system were confirmed by a cell's completion of 2129 cycles at 10 ma/cm^2 at 25°C. Polysulfone case and frame parts were found to be superior to PPO, due to the difficulty in injection molding PPO and warpage and distortion of PPO frame parts in service. Gassing tests were completed at 25° and 100°C. It was found that no significant gassing occurs at room temperature regardless of the charge state of the cell; also, if the cell is in the argenteous charge state, no gassing occurs at 100°C. While cycling at current densities up to 20 ma/cm^2, little gassing occurs at 25°C on a 1/2 to 1 hour regime. It was experimentally determined that potassium hydroxide concentrations ranging from 30 to 45% can be used satisfactorily with the system. D.T.

N66-29431*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

SURFACE PROPERTIES OF THERMIONIC ELECTRODES Semiannual Report, 1 Nov. 1964–30 Apr. 1965

R. E. Stickney 30 Apr. 1965 10 p refs

(Grant NGR-22-009-091)

(NASA-CR-62755) CFSTI: HC $1.00/MF $0.50 CSCL 10A

An experimental apparatus is being developed to investigate the surface processes affecting the performance of thermionic energy converters. The apparatus consists of an ultrahigh vacuum chamber capable of attaining the conditions for maintaining clean surfaces for extended periods, a single crystal refractory metal test specimen of known orientation and surface structure, a molecular beam device for depositing alkali metals on the test surface at a known rate, an electron gun, and auxiliary equipment for measuring the work function of the test surface by means of the retarding potential technique. A general description of the apparatus is presented along with an explanation of the main features of the retarding potential technique. All components have been designed and built, and the circuits, electron gun, crystal heater, and vacuum system have been tested. R.N.A.

N66-29438*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

APOLLO SPACECRAFT GASEOUS NITROGEN DELUGE SYSTEM

D. C. Smith, T. A. Lallas, and D. T. Norton 10 Aug. 1964 11 p

(NASA-TM-X-56521; TR-80-2-D) CFSTI: HC $1.00/MF $0.50 CSCL 22B

One of two gaseous nitrogen deluge systems examined in this report is proposed to inert a hazardous hydrogen atmospheric conditions which may exist in the command module cavity, service module compartment, LEM adapter compartment, or instrument unit of the Apollo spacecraft. This system will supply gaseous nitrogen of deluge proportions to the Apollo compartments to dilute and displace the oxygen content in the air creating an inert atmosphere which shall be considered 97% pure nitrogen or less than 4% hydrogen.

Author

N66-29520*# Electro-Optical Systems, Inc., Pasadena, Calif.

ADVANCEMENT IN THE STATE OF THE ART IN THE PRODUCTION OF FIELD SOLAR CELLS Final Report

P. Rolik 16 Dec. 1965 48 p refs

(Contract NAS5-9612)

(NASA-CR-75866; EOS-6973-Final) CFSTI: HC $2.00/MF $0.50 CSCL 10A

The results of a study to develop an improved radiation-resistant solar cell by the incorporation of an electrical field

are described. Included are the results of a theoretical computer evaluation, drift field fabrication experiments, and radiation damage data. The radiation damage data shows the results of saturation current, and the diode equation A factor change as a result of irradiation on a sample group of cells. The degradation characteristics of these cells are also given under tungsten and sunlight illumination. Author

N66-29631*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ELECTRICAL POWER AND SEQUENTIAL SYSTEMS

Percy Miglicco, Robert Cohen, and Jesse Deming *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 47-56 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Consideration is given to power sources for the Gemini electrical system, fuel cells in Gemini V and Gemini VII, and the sequential system which provides electrical control of the spacecraft. Reentry and squib batteries postflight discharge data are tabulated for Gemini spacecrafts II through VII, and electrical load profiles are given for the fuel cell power systems. Load sharing of the fuel cell stacks, given for the first and eighth days of the Gemini V mission, declined by 7.7% in one section and improved 7.7% in the other. Since the cryogenic oxygen heater circuit failed about 26 minutes after the start of the Gemini V flight, oxygen-usage rate was calculated from the hydrogen data. Two methods were used to determine the water-generation rate of the fuel cell, with production rates obtained by both methods in close agreement with theoretical predictions and ground test results. Fuel cell section performance and reactant usage rate are also discussed for Gemini VII. The man-in-the-loop concept of manually performing non-time critical sequential functions is found to be a reliable mode of operation. M.W.R.

N66-29685*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FEASIBILITY STUDIES OF SPACE RADIATORS USING VAPOR CHAMBER FINS

Henry C. Haller and Seymour Lieblein Washington, NASA, 1966 39 p refs Presented at Heat Pipe Conf., Albuquerque, N. Mex., 1 Jun. 1966 Sponsored by AEC and Sandia Labs. (NASA-TM-X-52219) CFSTI: HC $2.00/MF $0.50 CSCL 10B

The objective of this paper is to present some results of feasibility studies of space radiators imcorporating vapor chamber fins, as intended for application to Rankine system powerplants. Included in the presentation are: (1) a comparison of the weight and geometry characteristics of several vapor-chamber-fin and conducting-fin radiators; (2) an indication of the sensitivity of vapor-chamber radiator weight to capillary flow variables; (3) a compilation of capillary internal-flow requirements; and (4) a discussion of anticipated problem areas. Author

N66-29751*# TRW Systems, Redondo Beach, Calif.

CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS. XII: EFFECTS OF HIGH ENERGY ELECTRONS IN SILICON AND SILICON SOLAR CELLS Final Technical Report, 26 May 1965-26 May 1966

J. R. Carter, R. G. Downing, and H. Flicker 25 May 1966 76 p refs

(Contract NAS5-3805)

(NASA-CR-76043; TRW-4161-6023-R0000) CFSTI: HC $3.00/MF $0.75 CSCL 10A

A broad experimental program was conducted to study the effects of electron bombardment in silicon and silicon solar cells. It was found that the defect introduction rate of the E_v+0.3ev level is independent of dopant material in crucible grown p-type silicon. It appears that the defect does not involve a dopant impurity and depends on the presence of oxygen for its formation. These findings are consistent with previous suggestions that the silicon K center and the E_v+0.3ev level are related to the same defect and also with the currently proposed model that the K center is a double oxygen, double vacancy complex, or a double A center. A series of experiments were performed on the dependence of solar cell degradation under electron bombardment on irradiation temperature. It is observed that both p/n and n/p solar cells exhibit recombination center introduction rates which are independent of temperature over a range of 77°K to 373°K for p/n solar cells and over a range of 198°K to 373°K for n/p solar cells. At 77°K n/p solar cells exhibit an apparent factor of 5 increase in degradation rate. Author

N66-29760*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.

EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS Second Annual Report of Cycle Life Test

D. E. Mains 13 May 1966 377 p refs

(NASA Order W-11252-B)

(NASA-CR-76034; QE/C-66-304) CFSTI: HC $7.00/MF $2.00 CSCL 10C

Cycle life tests were performed on nickel-cadmium, silver-cadmium, and silver-zinc cells. The cells were arranged in packs of five and ten units; the packs were cycled with a given set of test parameters until more than half the cells had failed. Cycling test parameters included: (1) ambient temperature—50°, 25°, and 0° C; (2) charge voltage limit—1.41, 1.49, 1.55 volts per cell; (3) percent depth of discharge—15, 25, and 40%; (4) percent of recharge—160, 125, and 115%; and (5) orbit period—1.5 and 3 hours. The ampere-hour capacity of each pack was measured at approximately 88 day intervals. As of December 31, 1965, a total of 51 of originally 84 test packs had failed. The remaining packs had completed from 516.6 to 738.5 days of continuous cycling. It was found that 50°C was, in general, an unsatisfactory ambient temperature for the specified currents and orbit periods due to inefficient charge acceptance and accelerated separator deterioration. D.T.

N66-29761*# Electro-Optical Systems, Inc., Pasadena, Calif.

HYDROGEN-OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS, AUGUST 1-SEPTEMBER 1, 1965

Martin Klein 10 Sep. 1965 22 p

(Contract NAS3-2781)

(NASA-CR-76031; EOS-4110-ML-20) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Emphasis was placed on the testing of single cells with various electrode structures. Details are given on the test procedures, and the voltage performance, voltage-current, and KOH saturation pressure data are graphed. Results indicate that performance degradation can occur even though nickel is not present in the electrochemical reaction zone. It is suggested, since KOH is lost during cycling, that the asbestos/electrolyte interface is the cause of performance degradation. A 34 series cell 500 watt prototype was also assembled and tested. The multicell unit tests showed that the mechanical design was satisfactory, that the unit is capable of running continuously in excess of 500 watts, and that it has an overload capability greater than 2.5 times nominal. N.E.N.

N66-29806*# AiResearch Mfg. Co., Phoenix, Ariz.
BRAYTON CYCLE 3.2-INCH RADIAL COMPRESSOR PERFORMANCE EVALUATION
G. L. Perrone and H. H. Milligan May 1966 130 p refs
(Contract NAS3-6463)
(NASA-CR-54968; APS-5214-R) CFSTI: HC $4.00/MF $1.00 CSCL 10B

A test program was undertaken to determine the overall and component efficiencies of an existing compressor stage (3.2 inch diameter impeller) over a wide range of Reynolds numbers. A redesigned diffuser was also tested to determine design capability in improving peak performance at low compressor inlet pressure conditions. Results indicate that although the diffuser efficiency was slightly increased at the lower Reynolds numbers, some improvement could also be noted at all pressure levels. Reasonable correlation is obtainable for stage efficiency versus Reynolds number. The program confirmed that it is possible to predict the performance of a given compressor geometry in one fluid from data taken in another fluid. Test results indicate that an improvement in the art of temperature sensing, at low fluid flows and pressures, is desired. Author

N66-29981# Hughes Aircraft Co., Culver City, Calif. Technical Library Services.
NICKEL-CADMIUM BATTERIES Bibliography, 1940-Dec. 1965
J. Seremak Apr. 1966 88 p refs
(LS-BIB-66-1)

Nickel-cadmium batteries and their characteristics are reported in this annotated bibliography. Articles on the following technological aspects are listed: preliminary evaluation; environmental, performance, reliability and life cycle testing; improvement, evaluation and manufacture of advanced development models. Also included for many types of such vented and sealed batteries and cells were abstracts on: charging characteristics, thermodynamic properties, gassing, cryogenic operation, sterilization and radiation effects, recharging methods, sintering, voltage regulation and conversion, positive and negative plate performance, heat dissipation and impedance. Their use as battery power and solar array power systems for satellites, and as portable instruments and acoustic transponders, as well as their application to military, naval, signal corps and spacecraft communication technological requirements are also indicated. Entries are arranged alphabetically under personal or corporate author. R.Ll.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-28418*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
STUDY OF THE LIMINAL ANGLE OF A PLAGIOGEOTROPIC ORGAN UNDER WEIGHTLESSNESS Final Report
S. P. Johnson 29 Mar. 1964 56 p
(Contract NAS2-1539)
(NASA-CR-75686; SID-64-700; AD-457765) CFSTI: HC $3.00/MF $0.50 CSCL 06F

Included is a discussion of the general background and requirements underlying the study effort. Specific procedures and results are summarized and discussed. In addition, the requirements, constraints, design features, and test results of laboratory preprototypes are presented. (Preprototypes were designed and fabricated to serve as a basis for flight hardware.) The general requirements and design considerations for a spaceflight biological package are described. Finally, overall study findings are summarized, with specific problem areas and recommendations for further research. Author

N66-28425*# Chicago Univ., Ill. Dept. of Biophysics.
EXOBIOLOGY STUDY: ANALYTICAL SYSTEMS FOR BIOLOGICAL STUDY OF MARS. THE ROLE OF ELECTRON MICROSCOPY AND ELECTRON OPTICAL TECHNIQUES IN EXOBIOLOGY
Humberto Fernandez-Moran Apr. 1965 28 p refs Revised
(Grant NsG-441)
(NASA-CR-75702) CFSTI: HC $2.00/MF $0.50 CSCL 06F

Discussed are possible contributions of electron microscopy and related electron optics for experiments on Mars *in situ*, with telemetry back to earth. Application of high spatial resolutions of the order of 6 to 8 Å permit direct visualization of molecular structures and are of particular significance in the study of submicroscopic interstellar particles with diameters of a few tenths of a micron down to 10 to 100 Å. Electron microscopic methods can be readily adapted directly to TV cameras and thus represent a logical extension of vidicon microscopes for planetary exploration. A simple miniaturized electron microscope coupled directly into the same vacuum system with the television survey camera would possess a few hundred Angstrom units resolving power; its electron image could be converted by image intensifiers into electrical signals and sent to earth. Combinations of electron microscopes with X-ray sources can be used for microabsorption X-ray spectrometry; X-ray microdiffraction could detect collagen and other fibrous proteins in larger bulk samples; and different scanning microscopes would be valuable for analyses in the Martian rarefied atmosphere. G.G.

N66-28427*# Chicago Univ., Ill.
INTEGRATED RESEARCH AND TRAINING IN SPACE-MOLECULAR BIOLOGY Annual Progress Report, Apr. 1, 1965-Mar. 31, 1966
Humberto Fernández-Morán [1966] 94 p refs
(Grant NsG-441-63)
(NASA-CR-75698) CFSTI: HC $3.00/MF $0.75 CSCL 06C

The specimens collected by the Luster sounding rocket experiment during the Leonid meteor shower were examined by combined high resolution microscopy and electron diffraction techniques. The preliminary findings from these examinations are summarized in this report. The equipment, procedures for contamination control, and the conditions under which the studies were performed are discussed. Illustrations are provided which show that a number of characteristic particles have been found in the Luster on-flight specimens which are essentially similar to the three types of micrometeorite particles described by earlier investigators. Additionally, it is stated that application of low intensity electron microbeam illumination and specimen cooling, permitted the unexpected finding of an opaque electron sensitive material which appears to coat many of the particles, and is volatilized or degraded by electron bombardment. H.S.W.

N66-28455*# Public Health Service, Washington, D. C. Biophysics Section.
REDUCTION OF MICROBIAL DISSEMINATION, GERMICIDAL ACTIVITY OF ETHYLENE OXIDE, REDUCTION OF MICROBIAL CONTAMINATION ON SURFACES, EVALUATION OF LEAKAGE OF MICROBIAL CONTAMINATION FROM SPACE SUITS Quarterly Summary Report No. 7
May 1966 15 p
(NASA Order R-137)
(NASA-CR-75733) CFSTI: HC $1.00/MF $0.50 CSCL 06M

In continuing studies on planetary quarantine requirements, techniques were developed for measuring possible leakage into the ambient environment of microorganisms shed by humans wearing a prototype Apollo space suit. To estimate shedding, a suited subject was placed (unpressurized) into an environmentally controlled, dynamic, plastic isolator chamber for 30 minutes; various types of bacteriological air samplers were used to collect the viable particles. A modified microbiotank was used to measure the leakage of viable microorganisms from an occupied pressurized suit into a static environment. After test periods varying from 30 to 60 minutes, the microorganisms were collected and grown on appropriate culture media. A technique was also developed for artificially introducing tracer organisms into the suit. Tabulated data on microbial contamination are given for all tests. Comparative studies showed that a significant reduction of microbial dissemination occurred when a subject was dressed in clean room clothing, rather than in a surgical scrub suit. Preliminary findings are also reported on the continuing study of gaseous ethylene oxide activity against spores of *Bacillus globigii* on institutional dust particles. M.G.J.

N66-28521# Naval Research Lab., Washington, D. C. Chemical Oceanography Branch.
DETERMINATION OF DISSOLVED GASES IN BODY FLUIDS
J. W. Swinnerton *In its* Rept. of NRL Progr. Feb. 1966 p 1-5 refs (See N66-28520 16-23) CFSTI: $1.25

The U.S. Navy's SEALAB II experiment was conducted in August and September of 1965 off La Jolla, California. In this experiment, three teams, of ten men each, lived and worked at 205 feet below the ocean's surface for three separate 15-day periods. This report deals with one phase of NRL's participation in SEALAB, the measurement of dissolved inert gases in the divers' body fluids. Primarily, studies were made of the rate of elimination of helium and nitrogen during the critical decompression stage. The gas chromatography technique used in taking these measurements was developed at NRL. Author

N66-28524*# Public Health Service, Phoenix, Ariz. Technology Branch.
RECOVERY OF VIABLE MICROORGANISMS FROM SOLIDS. I: MODEL SYSTEMS
John R. Puleo, Martin S. Favero, Norman J. Petersen, and Gordon S. Oxborrow 8 Jun. 1966 28 p refs *Its* Rept.-13
(NASA Order R-137)
(NASA-CR-75693) CFSTI: HC $2.00/MF $0.50 CSCL 06M

Test solids were dental inlay material, plaster of Paris, and paraplast. Solid pellets were made by mixing an appropriate amount of these materials with a spore suspension of *Bacillus subtilis* var. *niger*. Pulverization was accomplished by the use of a blender-mill or mortar and pestle. Rates of recovery were low in preliminary tests when the mortar and pestle were used but modifications resulted in a significant increase in the percentage of viable microorganisms recovered. The physical state of the spore inoculum influenced the recovery rates. Significantly higher recoveries were obtained when spore suspensions which were cleaned either chemically with lysozyme or physically by differential centrifugation were used instead of conventional spore suspensions. Similar results were obtained with paraplast. Use of the blender-mill resulted in recovery of fewer viable spores from test solids than use of the mortar and pestle. However, the recoveries were consistent and significant enough to warrant routine use of the blender-mill. Author

N66-28585*# National Aeronautics and Space Administration, Washington, D. C.
RENAL FUNCTION DURING HEAVY MUSCULAR WORK [UEBER DIE NIERENFUNKTION WAEHREND SCHWERER MUSKELARBEIT]
F. Grande Covian and P. Brandt Rehberg Jun. 1966 26 p refs Transl. into ENGLISH from Skan. Arch. Physiol. (Scandinavia), v. 75, 1936 p 21-37
(NASA-TT-F-10205) CFSTI: HC $2.00/MF $0.50 CSCL 06P

Results on kidney function tests during and after heavy muscular work are discussed on the basis of a modified filtration-resorption theory, covering filtration in the glomeruli, resorption of water and of threshold substances in the tubuli, and back-diffusion of diffusible substances in the tubuli. Creatinine tests and urea clearance showed that a reduction in diuresis occurred during and after muscular work, proportional to the intensity of the work done. The presumable reason is an increased resorption, due to enhanced water loss. The filtration remained constant during light and moderate work, decreased during strenuous work, and returned to normal after stopping the exercise. Proteinuria after exhausting work was attributed to an incipient renal anoxemia. Author

N66-28744# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
ZOOMETRIC MEASUREMENTS AND ORGAN WEIGHTS OF THE BLACK BEAR Final Report
Neville P. Clarke and Stephen J. Doelker (Dayton Univ.) Dec. 1965 14 p refs
(AMRL-TR-65-199; AD-478869) CFSTI: HC $1.00/MF $0.50

Zoometric measurements and organ weights of 13 black bears used as experimental animals in the B-58 escape capsule development program are reported. These data are intended for use in future experiments where external dimensions of the test animal are required and for useful information in determining the comparability of the black bear to man in terms of biodynamics characteristics. Author (TAB)

N66-28746*# California Inst. of Tech., Pasadena. Div. of Biology.
NEURAL CONTROL OF HIBERNATION IN MAMMALS; THE RELEVANCE OF PHYSIOLOGICAL CLOCKS AND ENVIRONMENTAL FACTORS Progress Report, 1 Sep. 1965-28 Feb. 1966
[1966] 22 p refs
(Grant NGR-05-002-031)
(NASA-CR-74541) CFSTI: HC $1.00/MF $0.50 CSCL 06P

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2. PROCESSING AND ANALYZING HIBERNATION DATA RECORDED ON DIGITAL MAGNETIC TAPE J. A. Streeter p 12–17 refs (See N66-28748 16-04)

3. PROLONGED IN VITRO CULTURE AND AUTORADIOGRAPHIC STUDIES OF NEURONS IN APLYSIA Felix Strumwasser and Renate Bahr p 18

N66-28747*# California Inst. of Tech., Pasadena.
PARAMETER SELECTION FOR PERIODICITY MEASUREMENT BY THE METHOD OF POWER SPECTRAL ANALYSIS
Floyd R. Schlechte *In its* Neural Control of Hibernation in Mammals; the Relevance of Physiol. Clocks and Environ. Factors [1966] p 3–11 refs (See N66-28746 16-04) CFSTI: HC $1.00/MF $0.50

The equations of power spectral analysis were used to estimate periodicites in both computer generated and real data. The real data were brain temperatures recorded from squirrels of a hibernating species. From a study of the calculated results rules of thumb were developed for specifying the data grouping interval, the number of data groups, and the maximum lag in the autocorrelation coefficients for input to the power spectra. Author

N66-28748*# California Inst. of Tech., Pasadena.
PROCESSING AND ANALYZING HIBERNATION DATA RECORDED ON DIGITAL MAGNETIC TAPE
John A. Streeter *In its* Neural Control of Hibernation in Mammals; the Relevance of Physiol. Clocks and Environ. Factors [1966] p 12–17 refs (See N66-28746 16-04) CFSTI: HC $1.00/MF $0.50

This report is a follow-up of a data acquisition program previously described which is designed to compress, reformat, and summarize the magnetic tape record of several intermixed time series. A brief description of the program is included. Difficulties which were encountered in processing the data are discussed along with their solutions. Also included is a description of a program to check, edit, and combine tapes used for data storage, a summary of tape processing expenses, and a description of some of the graphical and statistical techniques used in analyzing hibernation data. R.N.A.

N66-28765*# Syracuse Univ., N. Y. Biological Research Labs.
STUDIES ON TRACE ELEMENTS IN THE SPORULATION OF BACTERIA AND THE GERMINATION OF BACTERIAL SPORES Informal Semi-annual Report, 1 Jan.–31 May 1966
Ralph A. Slepecky [1966] 8 p refs
(Grant NsG-693)
(NASA-CR-75764) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Previous studies and efforts to understand the relationships between trace elements and the formation of spores and their subsequent dormancy and germination are reviewed, and work continuing in the following areas is reported: trace elements and germination in a highly purified system; comparison of the germination of asynchronously grown with synchronously grown spores; and temperature induced sporulation mutants. Results of the purification procedures, the validity of which was confirmed by atomic absorption spectrophotometry, are being checked further since the findings may simplify studies of ion involvement. Further comparisons of spores formed in both synchronous and asynchronous growth systems led to the conclusion that the effect of age on germinative ability could not be observed clearly using the asynchronous system; conversely, results using the synchronous system appeared to be intrinsically similar, if not parallel. Examination continues on temperature induced sporulation mutants in *Bacillus subtilis* to ascertain whether mutants with increased heat resistance may be induced. R.L.I.

N66-28777*# Naval Air Engineering Center, Philadelphia, Pa. Aerospace Crew Equipment Lab.
A REPORT OF THE PHYSIOLOGICAL, PSYCHOLOGICAL, AND BACTERIOLOGICAL ASPECTS OF 20 DAYS IN FULL PRESSURE SUITS, 20 DAYS AT 27,000 FEET ON 100% OXYGEN, AND 34 DAYS OF CONFINEMENT, PART I
Kenneth R. Coburn 1 Apr. 1966 94 p refs
(NASA Order T-25750-G)
(NASA-CR-65394; NAEC-ACEL-535, Pt. I) CFSTI: HC $3.00/MF $0.75 CSCL 06S

The study was designed to validate the 100% oxygen (258 mm Hg) gaseous environment for 20 days with 7 days each of pre- and post-run evaluations. Studies include: renal and pulmonary function, retinal vascular changes, extensive blood work, nutrition, metabolic and water balance, bacteriological flora alterations, psychological manifestations, and full pressure suit and personal hygiene evaluations. While certain significant psychological alterations were observed, the physiological studies disclosed no significant variations from normal values. The atmosphere was well tolerated; however, 20 days constant full pressure suit wear posed some special problems. Author

N66-28778*# Naval Air Engineering Center, Philadelphia, Pa. Aerospace Crew Equipment Lab.
A REPORT OF THE PHYSIOLOGICAL, PSYCHOLOGICAL, AND BACTERIOLOGICAL ASPECTS OF 20 DAYS IN FULL PRESSURE SUITS, 20 DAYS AT 27,000 FEET ON 100% OXYGEN, AND 34 DAYS OF CONFINEMENT, PART II
Kenneth R. Coburn 1 Apr. 1966 130 p refs
(NASA Order T-25750-G)
(NASA-CR-65395; NAEC-ACEL-535, Pt. II) CFSTI: HC $4.00/MF $1.00 CSCL 06S

The effects on individual and group performance of six men confined for 34 days in an area of about 100 ft^3 per man under variable conditions of oxygen concentration, simulated altitude, and wearing apparel were determined. It was postulated that during any prolonged type of confinement the physical, social, and sensory environments become highly structured. The pattern environment affects the perceptual processes and social interactions, and thus affects higher mental activity. Overall, the experimental data regarding errors made in responses to stimuli reveal only minor fluctuations from day to day with minimal or no decrement in performance over time for either the group or individual; and regardless of the altitude, oxygen concentration, or flight clothing condition. Tables of data for the row and column errors are given. A major finding of the study was the increase in differences between estimates and correct responses of the subjects (defined as level of aspiration) for both individual and group performance. Other experimental details (equipment used e.g.) are also given. L.S.

N66-28783*# Naval Air Engineering Center, Philadelphia, Pa. Aerospace Crew Equipment Lab.
A REPORT OF THE PHYSIOLOGICAL, PSYCHOLOGICAL, AND BACTERIOLOGICAL ASPECTS OF 20 DAYS IN FULL PRESSURE SUITS, 20 DAYS AT 27,000 FEET ON 100% OXYGEN, AND 34 DAYS OF CONFINEMENT, PART III Final Report, 2 Jun. 1964–Nov. 1965

Kenneth R. Coburn 1 Apr. 1966 48 p refs
(NASA Order T-25750-G)
(NASA-CR-65396; NAEC-ACEL-535, Pt. III) CFSTI: HC $2.00/MF $0.50 CSCL 06S

The study was designed to validate the 100% oxygen (258 mmHg) gaseous environment for 20 days with 7 days pre and post run evaluations. Studies include: renal and pulmonary function, retinal vascular changes, rather extensive blood work, nutrition, metabolic and water balance, bacteriological flora alterations, psychological manifestations, and full pressure suit and personal hygiene evaluations. While certain significant psychological alterations were observed, the physiological studies disclosed no significant variations from normal values. The atmosphere was well tolerated; however, 20 days constant full pressure suit wear posed some special problems. Author

N66-28784*# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
EFFECTS OF ORAL ADMINISTRATION OF A FUEL CELL PRODUCT WATER TO *MACACA MULATTA* Final Report, Jan.–Feb. 1965
Ralph F. Ziegler Mar. 1966 28 p Joint NASA/USAF Study
(NASA Order T-31248-G)
(NASA-CR-75787; ARML-TR-65-176) CFSTI: HC $2.00/MF $0.50 CSCL 06C

A fuel cell product water, proposed as a supply of drinking water in space vehicles, was administered to *Macaca mulatta* at a rate of 35 ml per kg twice daily as the sole source of fluid intake for a 14-day period. Two of eight animals exhibited body weight and hematologic changes that were directly related to enteric disturbances. These, however, were apparently of a spontaneous nature since one of two control animals was also affected, although somewhat less severely. No apparent subacute oral toxicity of the fuel cell product water was demonstrated in monkeys. This indicates that product water having similar chemical and physical properties should present no serious hazard to humans when consumed as drinking water for short periods of time. Author

N66-28800*# National Biomedical Research Foundation, Silver Spring, Md.
INVESTIGATION OF THERMODYNAMIC MECHANISMS FOR THE PRODUCTION OF COMPLEX COMPOUNDS ESSENTIAL FOR THE ORIGIN OF LIFE Final Report, 1 Oct. 1965–30 Sep. 1966
Margaret O. Dayhoff, Richard V. Eck, and Ellis R. Lippincott [1966] 127 p refs
(Contract NSR-21-003-002)
(NASA-CR-74559) CFSTI: HC $4.00/MF $1.00 CSCL 06C

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2. THERMODYNAMIC EQUILIBRIUM IN THE ORIGIN OF ORGANIC MATTER E. R. Lippincott, Y. T. Pratt (Md. Univ.), R. V. Eck, and M. O. Dayhoff 22 p refs (See N66-28802 16-06)

3. EVOLUTION OF THE STRUCTURE OF FERREDOXIN BASED ON SURVIVING RELICS OF PRIMITIVE AMINO ACID SEQUENCES R. V. Eck and M. O. Dayhoff 16 p refs (See N66-28803 16-04)

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6. THERMODYNAMIC EQUILIBRIUM ON THE PREBIOLOGICAL EARTH M. O. Dayhoff and R. V. Eck 1 p

7. PROTEIN SEQUENCES TREATED AS MATHEMATICAL PUZZLES: AN ATLAS OF PROTEIN SEQUENCE AND STRUCTURE Richard V. Eck and Margaret O. Dayhoff 1 p

8. PROGRAM RELATE M. O. Dayhoff and R. V. Eck 1β p (See N66-28804 16-04)

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N66-28803*# National Biomedical Research Foundation, Silver Spring, Md.
EVOLUTION OF THE STRUCTURE OF FERREDOXIN BASED ON SURVIVING RELICS OF PRIMITIVE AMINO ACID SEQUENCES
Richard V. Eck and Margaret O. Dayhoff *In its* Invest. of Thermodyn. Mech. for the Production of Complex Compds. Essent. for the Origin of Life [1966] 16 p refs (See N66-28800 16-04) CFSTI: HC $4.00/MF $1.00
(Grants NIH GM-12168; NIH GM-08710)
(NBR-660101-20878)

The present-day structure of ferredoxin, with its simple, inorganic active site and its functions basic to photon-energy utilization, suggests the incorporation of its prototype into metabolism very early during biochemical evolution, even before complex proteins and the complete modern genetic code existed. The information in the amino acid sequence of ferredoxin enables us to reconstruct its evolutionary history. It has evolved by doubling a shorter protein, which may have contained only eight of the simplest amino acids. This shorter ancestor in turn developed from a repeating sequence of the amino acids alanine, aspartic acid or proline, serine, and glycine. The living relics of this primordial structure persist today because of a conservative principle in evolutionary biochemistry: Natural selection inhibits with extreme severity any change in a well-adapted system on which several other essential components depend. Many such intricate details of the earliest stages of life must still survive, awaiting detection and elucidation. Author

N66-28804*# National Biomedical Research Foundation, Silver Spring, Md.
PROGRAM RELATE
Margaret O. Dayhoff and Richard V. Eck *In its* Invest. of Thermodyn. Mech. for the Production of Complex Compds. Essent. for the Origin of Life [1966] 16 p (See N66-28800 16-04) CFSTI: HC $4.00/MF $1.00

A computer program is described which compares the sequences of amino acids in two proteins to determine the regions in which they might be identical or related in structure, through either function similarity or evolution from a common ancestor. Each fragment of a given length from one protein was compared with each such fragment from the other. A relatedness score was accumulated for each fragment; successive values were determined by a matrix element between the acids in corresponding fragment positions. A matrix of relatedness was used to estimate the probability of replacement of each amino acid by the other. Since gaps may occur in protein sequences as they evolve, fragments of arbitrary length were matched in such a way that when a gap occurs it will introduce

only a slight irregularity. Since the optimum length of test fragments varies, this number was set separately for each run, depending on the anticipated relatedness of the two proteins. A weighting function, tapering off at the ends of the fragment, may also be used in computing the scores. L.E.W.

N66-28805*# National Biomedical Research Foundation, Silver Spring, Md.
PROGRAM ALLELE
Richard V. Eck and Margaret O. Dayhoff *In its* Invest. of Thermodyn. Mech. for the Production of Complex Compds. Essent. for the Origin of Life [1966] 6 p (See N66-28800 16-04) CFSTI: HC $4.00/MF $1.00

From the observation of many alleles, a matrix of relative deviations from random pairing was formulated by the computer program described. This matrix can determine a score of relatedness of two more distant amino acid sequences, e.g., myoglobin and hemoglobin. Based on the frequency of occurrence of each acid in all alleles and assuming random replacements, an expected frequency of each pair was computed. A matrix of the deviations of the observed values from the expected values was derived. The allele data was smoothed by including corrections to the terms based on correlation of the behavior of each pair of amino acids with each of the others. A grouping of the acids for similarity of function can be made on the basis of the correlations. L.E.W.

N66-28819*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EXPERIMENTAL STUDY OF STERILE ASSEMBLY TECHNIQUES, VOLUME I Final Report
W. Hansen et al 21 Mar. 1965 187 p Prepared for JPL (Contracts NAS7-100; JPL-950993)
(NASA-CR-75789; M-56-65-1, Vol. I) CFSTI: HC $5.00/MF $1.25 CSCL 06F

A sterilization technique for aseptic assembly of a spacecraft and its heat-sensitive subsystems is examined as an alternative to total heat sterilization. Efforts focused on the assembly of an electronic circuit, as its manufacture is similar to the operations and processes used in assembling a Mars landing spacecraft. Glove box techniques for the electronic-circuit assembly are described. The individual processes of hand soldering, dip soldering, nut and bolt connecting, staking, epoxy bonding, and potting were tested first for the effects of gas atmosphere and assembly techniques, and then from the standpoint of sterility achievement. Effects of ethylene oxide/Freon 12, sterile air, and sterile nitrogen on circuit components were measured. Tests were conducted to determine causes of contamination, and bacteriology reports were compiled from sterilization assays. S.P.

N66-28820# Chicago Univ., Ill. USAF Radiation Lab.
USAF RADIATION LABORATORY QUARTERLY PROGRESS REPORT
15 Jan. 1966 39 p refs
(Contracts AF 41(609)-1693; AF 41(609)-2977)
(QPR-58; AD-629311) CFSTI: HC $2.00/MF $0.50

Contents: Further studies on the effects of various drugs on the adenosine triphosphatase activity of the hematopoietic tissues of rats exposed repeatedly to cobalt-60 gamma radiation; Studies on the effect of X-radiation on the hexobarbital metabolizing system of liver microsomes; Hypobaric oxygen exposure and acute radiation lethality in mice. TAB

N66-28821# Chicago Univ., Ill. USAF Radiation Lab.
FURTHER STUDIES ON THE EFFECTS OF VARIOUS DRUGS ON THE ADENOSINE TRIPHOSPHATASE ACTIVITY OF THE HEMATOPOIETIC TISSUES OF RATS EXPOSED REPEATEDLY TO COBALT-60 GAMMA RADIATION
Robert G. Tardiff and Kenneth P. Du Bois *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jan. 1966 p 1–14 refs (See N66-28820 16-04) CFSTI: HC $2.00/MF $0.50

Measurements were made of the influence of various drugs on the radiation-induced increase in the adenosine triphosphatase activity of the hematopoietic tissues of rats exposed to daily doses of cobalt-60 gamma radiation given at the rate of 46 to 54 R per day. The rats were also treated daily with yeast extract, liver concentrate, dessicated liver, various liver fractions, or acridine orange at various doses administered either intraperitoneally or orally. Groups of four animals were sacrificed after four days of radiation and drug treatment, and adenosine triphosphatase assays were performed on the spleens. Results indicate: (1) intraperitoneal administration of the drugs provided more protection against enzyme change than the oral treatment. (2) The greatest protection was obtained with yeast extract and two of the liver fractions. (3) The response of male and female rats to chronic gamma radiation was similar, but male rats were slightly more resistant. (4) Substances which proved effective in reducing hematopoietic injury to rat spleens exposed to gamma radiation were ineffective against X-ray at the same daily dose at a more rapid dose rate. L.E.W.

N66-28822# Chicago Univ., Ill. USAF Radiation Lab.
STUDIES ON THE EFFECT OF X-RADIATION ON THE HEXOBARBITAL METABOLIZING SYSTEM OF LIVER MICROSOMES
Kei-Ming Yam and Kenneth P. Du Bois *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jan. 1966 p 15–25 refs (See N66-28820 16-04) CFSTI: HC $2.00/MF $0.50

The effect of X-radiation on the resynthesis of the hexobarbital metabolizing enzyme system in the regenerating livers of partially hepatectomized adult male rats was studied. It was found that complete resynthesis of this enzyme system occurs within 22 days after partial hepatectomy; however, in rats subjected to X-radiation this process was reversibly inhibited. The extent of the X-radiation inhibition of the resynthesis process was found to be somewhat dependent on the X-radiation administration time. A greater degree of inhibition was obtained when X-ray was administered at 11 to 13 hours after hepatectomy than at 40 to 45 hours. L.E.W.

N66-28823# Chicago Univ., Ill. USAF Radiation Lab.
HYPOBARIC OXYGEN EXPOSURE AND ACUTE RADIATION LETHALITY IN MICE
J. Doull and V. Pizak *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jan. 1966 p 26–32 refs (See N66-28820 16-04) CFSTI: HC $2.00/MF $0.50

Eight groups of adult male mice were exposed to acute whole-body X-irradiation in the dose range of 400 to 700 R under environmental conditions of hypobaric oxygen (100% O_2 at 5 psia) and air to determine whether this environmental situation would alter acute radiation lethality in this species. It was found that no significant difference existed in the 30 day LD_{50} obtained for animals irradiated in the hypobaric oxygen environment and that of animals irradiated in air. The mice irradiated under hypobaric oxygen conditions exhibited, however, a slightly shortened median survivial time, especially in the mid-lethal X-ray dosage range. Author

N66-28895# Joint Publications Research Service, Washington, D. C.
THE PROBLEM OF LIGHT PULSE TREATMENT OF SEEDS AND PLANTS
A. A. Shakhov *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 82-99 refs (See N66-28888 16-15) CFSTI: $4.00

Yield in vegetables and other crops can be increased in volume and/or size by irradiating the seeds or plants with pulse concentrated solar light (PCSL) for periods of 20 to 45 minutes. Tubers, seeds, and seedlings were irradiated by PCSL, which provides an intermittent reflected radiant flux, in a series of experiments. Such pulses left an intense formation of photoinduced unpaired electrons; and the number of so-called paramagnetic resonance centers in the seeds and leaves increased with the increase in number of pulses and the moment of saturation. The free radical decreased somewhat through the recombination process. Gain in weight of tomato crops was shown to be between 20 and 30%, and yield of berries increased between 30 and 40%. M.W.R.

N66-28929# Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.
POTENTIAL HAZARDS AS A RESULT OF INHALATION OF RADIOIODINES: A LITERATURE SURVEY
Ronald E. Engel 5 Jan. 1966 95 p refs
(SWRHL-13R; TID-22693) CFSTI: HC $3.00/MF $0.75

A brief survey was made on the potential hazards to man which might result from releases of radioiodines into the biosphere. The related topic of potential hazards from ingestion of radioiodine is also considered since the determination of total hazard to man must be the ultimate goal of any research program which has been designed to assess the overall public health significance of any radioiodine releases. Research problems are also suggested. (124 references). NSA

N66-28934# Johns Hopkins Univ., Baltimore, Md.
THE ACTION OF RADIATION AND OTHER MUTAGENIC AGENTS. 1: IN INDUCING MUTATION IN DROSOPHILA FEMALES, AND 2: IN CONTROLLING THE ACTION OF SPECIFIC GENES RESPONSIBLE FOR SUPPRESSING UNCONTROLLED GROWTH Final Report, 1 May 1953-31 Dec. 1965
Bentley H. Glass 28 Feb. 1966 36 p refs
(Contract AT(30-1)-1472)
(NYO-1472-1) CFSTI: HC $2.00/MF $0.50

Progress is reported on studies of: the comparative mutagenic effects of ionizing radiations on males and females of *Drosophila melanogaster* at comparable stages of the germ line; the action of suppressor genes in Drosophila; and the effect of mating pattern on life span in Drosophila. A bibliography of 25 papers published during the contract period is included. NSA

N66-28935# Kernforschungsanlage, Juelich (West Germany).
THE DETECTION OF INCORPORATED PLUTONIUM [UEBER DEN NACHWEIS VON INKORPORIERTEM PLUTONIUM]
H. Jacobs Oct. 1965 27 p refs In GERMAN
(JUL-312-ST)

A review is given on the present state of plutonium in men on the basis of a bibliographic study. For a better understanding of the methods and for evaluation of the results, some general properties of plutonium and its metabolism in the body are briefly described. The literature of the last 10 years is considered, but no claim to completeness is made. (144 references). Author (NSA)

N66-28943# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
CELLULAR AND BIOCHEMICAL RADIOBIOLOGY [RADIOLOGIE CELLULAIRE ET BIOCHIMIQUE] Final Report
A. Sassen et al Brussels, Belgium, EURATOM, 1965 25 p refs In FRENCH
(Contract EURATOM 014-62-1 BIOB)
(EUR-2201.f)

Using microelectrophoresis in agar, immuno-electrophoresis, and incorporation of amino-acids, the protein changes in the serum and various tissues of mice irradiated with a lethal and sublethal dose of X-rays were studied. The permeability of cellular and tissue membranes to macromolecules and the influence thereon of radiations were studied in both vegetable and animal organs (genital organs and hyperplasia, normal and cancerous tissues, embryo tissues). Data are included from studies of the intracellular distribution of the cytoplasmic hydrolases; the relation between the activity of acid DNAse and growth; the inhibition of DNA-polymerase by rat-liver microsomes the thymidine phosphokinases; and the isotopic effect of tritium. NSA

N66-28952# Brussels Univ. (Belgium).
APPLICATIONS OF CELL PHYSIOLOGY TO RADIOBIOLOGY [APPLICATIONS RADIOBIOLOGIQUES DE LA PHYSIOLOGIE CELLULAIRE. RAPPORT ANNUEL, 1964] Annual Report, 1964
1 Mar. 1965 58 p refs In FRENCH
(Contract EURATOM-007-61-10 BIAB)
(EUR-2457.f)

Research during 1963-1964 had to do mainly with the relationships between nucleic acids and proteins. The mechanism of genetic replication was studied in bacteriophages; the suppressor responsible for immunity inhibits the autonomous replication of the prophage and superinfecting phages of the same immunity by direct action, and not merely by preventing the synthesis of a diffusible substance needed for replication. Research into the DNA-RNA transcription mechanism led to the isolation and characterization of reticulocyte messenger-RNA and produced a clearer picture of the way blood-cells are formed in the course of embryo development. The very earliest stages of development (segmentation, gastrulation, neurulation) were also studied with the object of discovering the exact moment at which the various RNAs are synthesized. It was found that oogenesis is accompanied by the formation of numerous ribosomes and of messenger and transfer RNA, together with substantial DNA reserves in the cytoplasm; all these reserves are used during segmentation of the eggs, and new syntheses occur during the start of gastrulation; this explains why the development of irradiated or hybrid embryos is arrested at the point where differentiation begins. It appears that new ribosomes form during differentiation, and study of their proteins in various adult tissues does in fact suggest that these tissues are differentiated in the course of ontogeny. Protein syntheses were investigated both under normal conditions (embryos, acetabularia) and under conditions where the synthesis is inhibited by chemical or physical (X-ray) agents or by natural inhibitors which may exercise an influence in the normal regulation of protein syntheses. Research on the nature and specificity of antibodies was concerned with two aspects. The first was the structure, genetic determination, and methods of biosynthesis of γ ontogeny. Protein syntheses were investigated both under normal conditions (embryos, acetabularia) and under conditions where the synthesis is inhibited by chemical or physical (X-ray) agents or by natural inhibitors which may exercise an influence in the normal regulation of protein syntheses. Research on the nature and specificity of antibodies was concerned with two aspects. The first was the structure, genetic determination, and methods of biosynthesis of γ globulins; in particular it was demonstrated that anti-TMV antibodies yield a residue which is mainly N-terminal alanine but that this is replaced by aspartic or glutamic

acid if the antigen is TMV thr+. Secondly, a new gene was revealed which governs the synthesis of 7S γ globulins.
Author (NSA)

N66-28959# California Univ., Berkeley. Lawrence Radiation Lab.
DARK RECOVERY AND GLYCEROL PROTECTION FOR DIPLOID SACCHAROMYCES CEREVISIAE
C. A. Tobias, N. M. Amer, J. K. Ashikawa, J. T. Lyman, L. W. Mc Donald et al Aug. 1965 33 p refs Presented at the 2d Intern. Symp. on Basic Environ. Probl. of Man in Space, Paris, [1965]
(Contract W-7405-ENG-48)
(UCRL-16377; CONF-650668-1) CFSTI: HC $2.00/MF $0.50

Studies with mice, rabbits, and primates indicated that the matter of radiation exposure to astronauts should be of serious concern for space flights of more than a few days' duration. In space flights of several weeks' or months' duration, accumulation of considerable amounts of proton and α-particle doses, particularly to the outer layers of the body, appears unavoidable. A study of unicellular mammalian cell cultures and of microorganisms showed that high-LET irradiation is more effective than low-LET irradiation in producing lethal effect and that there is interaction between the cellular effects of irradiation and other environmental stresses, including temperature, ultraviolet rays, chemical agents, magnetic fields, and vibration. These injuries are irreversible so that accumulating doses produce accumulating injury. At the cellular level, protection from radiation injury was achieved independently of LET with glycerol, and it was also found in yeast cells that postirradiation dark recovery may occur even from the heaviest ions.
NSA

N66-29001# Commissariat a l'Energie Atomique, Grenoble (France).
EFFECT OF FRACTIONATED X-RAY DOSES ON THE HEMOGRAM AND THE PROTEIN FORMULA OF THE MOUSE [ACTION DE DOSES FRACTIONNEES DE RAYONS X SUR L'HENOGRAMME ET LA FORMULE PROTEIQUE DE LA SOURIS]
Denise Alix and Theodore Pierotti Oct. 1965 32 p refs In FRENCH; ENGLISH summary
(CEA-R-2848)

The effects of small radiation doses on mice were studied. Irradiation *in toto* was performed at doses of 50, 100, 150 or 200 R according to groups, either as single or as fractionated doses. It was established that changes begin to become evident only after total exposure of 100R. A decrease of cellular constituents and more often than not an increase of total proteins and gamma-globulins occurred.
Author (NSA)

N66-29002# Virginia Univ., Charlottesville. Radiobiology and Biophysics Lab.
A STUDY OF DNA REPLICATION AND THE IMMEDIATE AND LONG TERM EFFECTS OF RADIATION ON RADIOSENSITIVE AND RADIORESISTANT MAMMALIAN CELLS Final Report
[1965] 40 p refs CFSTI: HC $2.00/MF $0.50
(Contract AT(40-1)-2889)
(TID-22644)

DNA replication was evaluated at four organizational levels: molecular, chromosomal, cellular, and intercellular, under the control and in the environment of the intact animal. Mathematical description of the systems shows the similarity of the systems at the different organizational levels. The data imply that constant monitoring through feed-back mechanisms is in operation to insure an orderly replication at the higher organizational levels. The effects of radiation on DNA replication and cell lethality were studied on a radiosensitive asynchronous population of cells in the intestines, and on a semi-synchronous population of a radioresistant liver cells under the following conditions: variation of total dose with a constant dose rate; variation in delivery time with a constant total dose; and variation of time between doses with a constant total dose. The depression of DNA synthesis was studied following delivery of total doses ranging from 750 to 24,000 R at a constant dose rate of 300R/minute. The parallel depression of both DNA synthesis and labeled cells suggests that a similar radioinduced mechanism is involved in DNA depression and cell lethality. Preliminary studies on radiosensitive (intestines) and radioresistant (liver) organs indicate that the effects of radiation on DNA synthesis are similar. DNA depression following fractionated doses of radiation (375R×2) and (750R×2) showed the same characteristic biphasic response curve as the dose rate and dose response studies. A one-month evaluation of the effects of single and multiple doses of radiation on somatic cells was made. The cells were irradiated near the midpoint of the eight hour replicating period of DNA during the first cycle of hepatocytes synthesizing DNA following partial hepatectomy. The results demonstrate that studies can be made on changes in the total population of cells and in a fraction of the cells synchronized within a specific phase of the cell cycle. Preliminary studies indicated that the effects of radiation on DNA synthesis are similar in both radioresistant and radiosensitive cells. *In vitro* studies were initiated on the relationship between radiation dose and chromosome aberrations in man.
NSA

N66-29030# Jefferson Medical Coll., Philadelphia, Pa.
SPECIALIZED RESPONSES TO IONIZING RADIATION Second Yearly Progress Report, 1 May 1965-30 Apr. 1966
Gary S. Shaber [1966] 21 p ref
(Contract AT(30-1)-3359)
(TID-22766) CFSTI: HC $1.00/MF $0.50

The technique of immunofluorescence was studied and a pilot experiment was carried out in rats to determine the specificity of antifibrinogen serum. The effects of whole-body X-irradiation, with and without epsilon amino caproic acid treatment, on fibrinogen deposition in rats was studied using ^{131}I-fibrinogen and whole-body counting, tissue radioassay, and autoradiography. Preliminary studies were made to determine if tumorcidal doses of radiation could be obtained with ^{131}I-fibrinogen combined with external radiation. Results indicate that the apparent whole-body turnover time of fibrinogen becomes progressively prolonged with increasing doses of whole-body radiation and that fibrinogen leaves the vascular space after whole-body irradiation and that epsilon amino caproic acid enhances the *in vivo* selective deposition of fibrinogen in liver, kidneys, spleen, pancreas, skin, and salivary glands. A taste threshold measuring device was constructed and the taste thresholds for glucose were determined before and after exposure of the tongue to 50 rad irradiation. A preliminary study on hypothalamic self-stimulation rates following head irradiation failed to reveal any significant changes in the taste response of rats exposed to doses of 300 to 1800 R head irradiation.
NSA

N66-29087# Battelle-Northwest, Richland, Wash.
COMPARATIVE INVESTIGATIONS ON THE DEFENSE MECHANISM OF CYSTEAMINE AND AET FOR "INTESTINAL RADIATION DEATH"
Zoltan B. Zsebook and Gyoezoe Petranyi, Jr. 1966 18 p refs Transl. into ENGLISH from Strahlentherapie (Munich), v. 127, 1965 p 452–462
(BNWL-TR-11)

The radiation protective mechanisms of AET and cysteamine for intestinal radiation death were investigated in rats. Sodium absorption in the small intestine and extracellular, exchangeable, or total sodium content, as well as the inulin volume and the serum sodium concentration were used as indicators for changes in the sodium- and liquid metabolism. The results showed that lethal disturbances in sodium- and liquid metabolism can be inhibited indirectly by cysteamine by means of mobilization of sodium–liquid reserves within the organism. AET did not protect significantly, however, in the small intestine; with the loss in sodium and liquid only slight protection was observed. Author (NSA)

N66-29100# Brookhaven National Lab., Upton, N. Y. Medical Research Center.
COMPARATIVE THERAPEUTIC EFFICACY OF HIGH-LET VERSUS LOW-LET RADIATIONS
V. P. Bond, C. V. Robinson, R. Fairchild, and G. Tisljar-Lentulis [1966] 37 p refs Presented at Conf. on Radiobiology and Radiotherapy, Colorado Springs, Colo., 1–3 Nov. 1965
(Contract AT(30-2)-GEN-16)
(BNL-10009; CONF-651143-1) CFSTI: HC $2.00/MF $0.50

Possible approaches in radiotherapy using high-LET radiations are discussed. Included are neutron capture therapy; accelerator beams; particularly protons and negative Pi mesons; fast neutrons; and the influence of changes in cell survival curves on possible efficacy of high-LET radiations. An effort was made to present objectively the advantages and difficulties of the various approaches. It is possible, in principle, that these approaches may provide effective modalities for therapy, and in particular, that high-LET radiation may aid in overcoming the problem of relative protection of tumor cells located in hypoxic areas within neoplasms. In all approaches, it is necessary to consider carefully the concomitant changes in shape of dose–cell survival curves that accompany the change from low- to high-LET radiation. It is clear that while all proposed approaches have intriguing features, each requires considerably more work before it can be shown to be a useful adjunct in radiotherapy. Author (NSA)

N66-29102# Texas A&M Univ., College Station. Radiation Biology Lab.
THE EFFECTS OF PRENATAL AND POSTNATAL GAMMA IRRADIATION ON REPRODUCTION IN THE ALBINO RAT
Final Report
George M. Krise 7 Sep. 1965 106 p refs
(Contract AT(40-1)-2849)
(TID-22378) CFSTI: HC $4.00/MF $0.75

A study was made to determine the effects of chronic low level radiation on the developing testes at specific intervals during pre- and postnatal development in two strains of albino rats. The investigation was divided into four phases to produce the required data necessary to locate stages of extreme sensitivity. Animals receiving 1 and 2 R per day were found to be different histologically from the controls. When 5 R was administered, only the rats irradiated from day 15 prenatal to day 3 of postnatal life showed histological damage to the testes. This damage was not evidenced at 170 days, indicating that regeneration of germinal epithelium had taken place by this time. A total dose of 100 R at the rate of 10 R per days caused damage which was still apparent at 170 days of age. Though animals exposed to this level of irradiation thus showed permanent histological damage, they were not found to be sterile when tested at 143 days of age. Administration of 20 R per day for a total dose of 200 R caused permanent sterility in the Sprague–Dawley rats, but Wistar rats exposed to the same dose were able to produce some litters. A dose of 40 R per day for a total dose of 400 R caused complete destruction of the germinal epithelium in both strains. Wister rats throughout the study were found to be more radioresistant than Sprague–Dawley rats in almost all cases. The results suggest that the damage to animals in the continuous prenatal and postnatal irradiation study was received during the prenatal and early postnatal period of irradiation. NSA

N66-29122# Brookhaven National Lab., Upton, N. Y. Biology Dept.
WEATHER MODIFICATION: THE EFFECT ON THE BIOLOGICAL EQUILIBRIUM IN THE PLANT COMMUNITY
R. H. Whittaker [1966] 24 p refs Presented at the Interdisciplinary Symp. in the Phys.-Biol.-Agr. Sci., AAAS Meetings, Berkeley, Calif., 28 Dec. 1966
(Contract AT(30-2)-GEN-16)
(BNL-9835; CONF-651211-2) CFSTI: HC $1.00/MF $0.50

The effects of change in amount of mean annual precipitation, and increase in mean annual temperature on plant communities are discussed. Agricultural plant communities are excluded. Recommendations are given concerning further ecological studies along these lines. NSA

N66-29125# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
RECOVERY AND RADIO-RESISTANCE IN MICE AFTER EXTERNAL IRRADIATION [RESTAURATION ET RADIO-RESISTANCE CHEZ LA SOURIS APRES IRRADIATION EXTERNE]
Sylvain Le Guillou Oct. 1965 80 p refs In FRENCH
(CEA-R-2776)

A review is presented on recovery from external irradiation and experimental data that suggest the idea of a radioresistance in animals, as well as the hypotheses put forward for explaining this phenomenon. An experiment was carried out on mice whose $LD_{50/30}$ days increased from 1005 to 1380 rads. It was found that an increase occurred in the number of certain anti-bodies circulating after a low dose of γ irradiation. 128 references are cited. Author (NSA)

N66-29131# Battelle-Northwest, Richland, Wash.
LONG-TERM STUDY OF INHALED PLUTONIUM IN DOGS
Technical Report, 1 Sep. 1963–30 Apr. 1966
William J. Bair, James F. Park, and William J. Clarke Kirtland AFB, N. Mex., AF Weapons Lab., Mar. 1966 62 p refs
(Contract AF 29(601)-62-1507)
(AFWL-TR-65-214; AD-631690) CFSTI: HC $3.00/MF $0.75

To determine the long-term translocation and biological effects of inhaled plutonium, 40 beagle dogs were given a single 10- to 30-min exposure to $Pu^{238}_{(02)}$ aerosols. Thirteen dogs died or were sacrificed when clinical signs indicated death was imminent 29 to 66 months postexposure. The body burdens at death ranged from 0.8 to 3 micro Ci with 40 to 75

percent of the body burden in the lungs, and 20 to 50 percent in the bronchial and mediastinal lymph nodes. The liver contained 2 to 21 percent, and the skeleton, 1 to 7 percent. Cardiopulmonary insufficiency and lymphopenia were the primary clinical signs. Pathology in the lungs consisted of severe fibrosis followed by alveolar cell hyperplasia, and bronchiolar and squamous types of metaplasia. Seven of the 13 animals showed bronchiolo-alveolar carcinomas, an incidence of 18 percent as compared to a reported canine primary lung-tumor incidence of 0.2 percent. The bronchial lymph nodes were composed of dense sclerotic connective tissue devoid of any lymphoid element. Metastases of the pulmonary tumor to the bronchial lymph nodes were seen in three animals. Twenty-three dogs with body burden of 0.3 to 1 micro Ci survived 4 to 6 years after exposure. Author (TAB)

N66-29145# California Univ., Berkeley. Operations Research Center.

ON STEADY-STATE INTERCOMPARTMENTAL FLOWS

Simon Levin, George B. Dantzig, and James Bigelow Aug. 1965 18 p refs

(Contract Nonr-222(83); Grant NIH GM-9606)

(ORC-65-26; AD-631370) CFSTI: HC $1.00/MF $0.50

The flow between compartments in physical and biological systems is treated as a special case of a more general theory of transitions between any two distinct sets. Interest is focused on the flow rate from each set, i.e., the rate at which elements from that set appear in the other; and on the entry rate from each, i.e., the rate at which elements from the set leave to enter the region not part of either set. In particular, the two flow rates are completely determined by means of explicit expressions for their rates and difference in terms of the two entry rates. An application to biological transport problems extends a result of Dantzig and Pace by demonstrating that for a system of channels each narrow enough to effect a 'lining-up' of particles, counter-gradient flows may result, i.e., flows for which the flow rate is greatest from the compartment with the smallest entry rate. Author (TAB)

N66-29147# Naval Training Device Center, Port Washington, N. Y.

THE EFFECTS OF INDUCED MUSCLE TENSION AND AUDITORY STIMULATION ON TACHISTOSCOPIC PERCEPTION

John L. Andreassi Mar. 1966 65 p refs

(NAVTRADEVCEN-IH-49; AD-631840) CFSTI: HC $3.00/MF $0.75

The effect of accessory stimulation upon tachistoscopic perception of geometric figures was studied. In experiment I, 32 subjects were tested on two successive days in a complete factorial design (subjects X treatments) in which degree of induced muscle tension (IMT) and level of task difficulty were manipulated. An IMT level of 1/2 of maximum resulted in significantly ($P<.01$) improved visual perception. In experiment II artificial pupils were employed to test the hypothesis that improved performance was due to pupil dilation. Eight subjects from experiment I were tested on five successive days and performance at 1/2 of maximum IMT was again significantly ($P<.05$) improved. Thus precluding pupil dilation as the reason for the results obtained in experiment I. In experiment II performance at the middle level of task difficulty benefited significantly ($P<.05$) from IMT. Experiment III investigated the effects of four levels of auditory stimulation (white noise) on tachistoscopic perception in a new group of 32 subjects. Perception was significantly ($P<.05$) improved with the 1/4 of maximum noise level at the easiest level of difficulty. Results were interpreted within the framework of the activation concept. Recent neurophysiological data point to the ascending reticular activating system as a possible mediator which could influence cortical and retinal areas in the facilitation of tasks such as tachistoscopic perception. Author (TAB)

N66-29167# School of Aerospace Medicine, Brooks AFB, Tex.

PROTECTION OF ENAMEL SURFACES BY COMMERCIAL AND LABORATORY-PREPARED STANNOUS FLUORIDE PROPHYLAXIS PASTES Final Report, Jan.–Nov. 1964

Ira L. Shannon Feb. 1966 16 p refs

(SAM-TR-66-15; AD-631204) CFSTI: HC $1.00/MF $0.50

A laboratory investigation was carried out in which both commercially available and laboratory prepared prophylaxis pastes were evaluated as to ability to decrease enamel solubility in lactic acid. Commercially available mixtures from which pastes containing approximately 8% to 10% stannous fluoride were prepared, reduced enamel solubility by about 60% to 80%. Higher concentrations of stannous fluoride provided somewhat more protection, but this increase was not sufficient to offset the disadvantage of increased clinical complications reported for these pastes. The incorporation of stannous fluoride in a prophylaxis mixture is to be recommended. While the subsequent topical application of a stannous fluoride solution is also desirable, it is recognized that the time required for this procedure must be markedly reduced if universal acceptance is to be attained. Author (TAB)

N66-29170# Delaware Univ., Newark.

THE EFFECT OF ASCORBIC ACID SUPPLEMENTATION AND ACCLIMATIZATION TO COLD ON THE ELECTROCARDIOGRAM OF THE GUINEA PIG EXPOSED TO COLD Progress Report

Charles G. Wilber and Frances Zeman (California Univ., Davis) Mar. 1966 91 p refs

(Contract DA-49-193-MD-2627)

(AD-631735) CFSTI: HC $3.00/MF $0.75

Guinea pigs were exposed until death in a cold chamber kept at 4° C to 5° C. Some of the guinea pigs were previously acclimatized to 22° C and to 8° C, respectively. Some were given vitamin supplements of 30 or 300 mg per kg ascorbic acid, others were given no vitamin supplement. Electrocardiograms were taken for all animals exposed. Measurements of the various intervals on the electrocardiograms including the heart rate indicated that the various treatments had no effect on the response of the heart to the cold.

Author (TAB)

N66-29226# California Univ., Berkeley. Operations Research Center.

BACTERIAL EXTINCTION TIME AS AN EXTREME VALUE PHENOMENON

Benjamin Epstein Mar. 1966 9 p refs

(Contract DA-31-124-ARO(D)-331; Grants NIH GM-9603, NSF GP-4593)

(ORC-66-8; AD-632205) CFSTI: HC $1.10/MF $0.50

The theory of extreme values is shown to be relevant in the analysis of two stochastic biological phenomena. Author (TAB)

N66-29241# Saskatchewan Univ., Saskatoon. Dept. of Physiology and Pharmacology.
PRECIPITIN RESPONSE TO HUMAN SERUM BY A RABBIT POPULATION. COMPARISON OF STRESSES ON SECONDARY PRECIPITIN RESPONSES
G. Bonar Sutherland and W. G. Glenn (School of Aerospace Med.) Brooks AFB, Texas. School of Aerospace Med., Apr. 1966 11 p refs Prepared in cooperation with School of Aerospace Med.
(Contract AF 41(657)-384)
(SAM-TR-66-27; AD-632250) CFSTI: HC $1.00/MF $0.50

The report analyzes the secondary precipitin response of a population of rabbits subjected to various stresses and stress combinations. As administered in this experiment, the following stresses and stress combinations produced a statistically significant depression of precipitin production (compared to controls) during the anamnestic response of rabbits to a complex antigen (human serum). These are rank-ordered with the stress producing the greatest effect at the head of the list: 6-mercaptopurine; 800 r whole-body gamma radiation immediately followed by 10 days at a simulated altitude of 15,000 ft.; splenectomy followed 21 days later by 800 r of gamma radiation; 800 r whole-body gamma radiation or 15,000-ft. simulated altitude for 10 days followed by 800 r whole-body gamma radiation; and splenectomy. The following stresses showed no significant effect: 15,000-ft. simulated altitude during the induction period; 15,000-ft. simulated altitude for 10 days before the induction period; major surgery involving implantation of dosimeters. Whole-body gamma radiation (800 r) immediately followed by 15,000-ft. simulated altitude resulted in a mortality of 58% within the first 48 hours of decreased atmospheric pressure. Altitude exposure before 800 r gamma radiation did not indicate any synergism or antagonism related to the anamnestic response. Stress did not appear to increase antibody levels in the absence of a booster injection.
Author (TAB)

N66-29271# School of Aerospace Medicine, Brooks AFB, Tex.
THE EFFECT OF GAS DENSITY ON THE WORK OF BREATHING IN MAN Final Report, Jan. 1964–Feb. 1965
Domenic A. Maio Mar. 1966 18 p refs
(SAM-TR-66-22; AD-632482) CFSTI: HC $1.00/MF $0.50

The effect of gas density on the work of breathing was studied in 3 normal male subjects. Gas density was varied by decreasing the barometric pressure in an altitude chamber, as well as by varying the percentage of oxygen with nitrogen and helium. Three frequencies of breathing were selected at 8, 16, and 24 breaths per minute to cover the resting physiologic range, with tidal volume adjusted to allow an alveolar ventilation of 6 liters per minute. There appeared to be a slight decrease in the total work of breathing at the lower gas densities, owing to a decrease in the nonelastic work of breathing. The elastic work was not influenced by gas density but did decrease with increasing breathing frequency. The nonelastic work likewise was affected by frequency, decreasing at the lower breathing frequencies. The order of magnitude of these changes, however, would probably not be of any practical significance and thus would not be a factor in the preferential selection of a particular gas mixture–cabin pressure combination for a manned space vehicular environment. Author (TAB)

N66-29273# Zurich Univ. (Switzerland).
ELECTRON MICROSCOPIC AND MORPHOMETRIC STUDY OF RATS EXPOSED TO 99.5 PERCENT OXYGEN AT ATMOSPHERIC PRESSURE Final Technical Report, Feb. 1964–Jul. 1965
Gonzague S. Kistler, Peter R. B. Caldwell (AMRL), and Ewald R. Weibel Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 47 p refs
(Contract AF 61(052)-784)
(AMRL-TR-65-66; AD-632296) CFSTI: HC $2.00/MF $0.50

Rats were exposed to 98.5% oxygen at 765 Torr in a controlled environmental chamber. Groups were sacrificed at 6, 24, 48, and 72 hours and the lungs were prepared for light and electron microscopic examination. A control group breathed room air. In the groups which breathed oxygen for 6 and 24 hours no changes in lung structure could be observed. After 48 hours the interstitial space was enlarged by accumulation of fluid and early destructive changes of the capillary endothelial lining were found. After 72 hours the widened interstitial space contained numerous leucocytes, thrombocytes, and other cells; fibrin strands were numerous. There was marked destruction of the pulmonary capillaries. At this stage, 65% of all alveoli were filled with an exudate containing leucocytes, erythrocytes, macrophages and fibrin strands. There was a decrease in capillary blood volume and of endothelial surface after 72 hours. The thickness of the air-blood barrier was increased after 48 and doubled after 72 hours. The barrier thickening was mainly due to increase of the interstitial space; terminally, the epithelium was also thickened, although the endothelium became thinner, on the average, due to destruction. As a result of these alterations there was a marked fall in estimated gas exchange capacity of the air-blood tissue barrier. Author (TAB)

N66-29279# Istituto Nazionale di Ottica, Florence (Italy).
DETECTION OF CIRCULAR LIGHT SIGNALS IN RELATION TO SHAPE AND COLOR IDENTIFICATION Preliminary Progress Report, 1 Dec. 1964–1 Feb. 1965
Lucia Ronchi and Rolando Titterelli Brooks AFB, Tex., School of Aerospace Med., Feb. 1966 18 p refs
(Contract AF 61(052)-850)
(SAM-TR-66-14; AD-632500) CFSTI: HC $1.00/MF $0.50

A small and brief circular spot was flashed at 7° nasal to the fovea. Absolute threshold, color identification threshold, and threshold of perception of the circle were determined. The number of wrong responses given by the subject when attempting to identify the color of the signal and the degeneration of apparent shape under degraded viewing conditions is presented. The radiation emitted by an incandescent lamp, 2800°K, was filtered by filters. The threshold of circular shape identification was found to be slightly higher than that of color identification. The findings were compared with the data reported in the current literature. Practical recommendations for the use of the data are given. Author (TAB)

N66-29300*# Washington State Univ., Pullman.
[STUDY OF INTERMEDIARY METABOLIC PROCESSES IN *HYDROGENOMONAS FACILIS*] Progress Report, Jan.–Jun. 1966
[1966] 9 p ref
(Grant NGR-48-001-004)
(NASA-CR-75883) CFSTI: HC $1.00/MF $0.50 CSCL 06A

To provide clues about the mechanism of $C^{14}O_2$ incorporation, experimental results are tabulated on the labeling patterns of glutamate and 3-phosphoglycerate (PGA) by $HC^{14}O_3^-$ during ribose oxidation by *Hydrogenomonas facilis*. In some short-term fixation studies, it was confirmed that TCA-cycle intermediates were not labeled by $C^{14}O_2$. Data support the operation of the Calvin cycle, although at a suppressed rate, during CO_2 fixation by *H. facilis* in the presence of ribose. Separate 10-second fixation studies have confirmed that C^{14} was first incorporated

into C_1 and 80% of the label was found; C^{14} was then distributed into C_5 and 20% of the label was found. Data obtained are consistent with the function of α-ketoglutarate synthase, which is known to catalyze a reductive carboxylation of succinyl CoA in photosynthetic bacteria. Failure to find a C^{14} radioisotope in intermediates of the tricarboxylic acid (TCA) cycle was unexpected; it is, however, evident that most enzymes of the TCA cycle are detectable and are probably constitutive in *H. facilis*. Several assays for pyruvate and α-ketoglutarate dehydrogenase have been conducted and results were uniformly negative. R.Ll.

N66-29324# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

AN ASSESSMENT OF THE FIRE RISKS OF THE OXYGEN ENVIRONMENT EXPERIMENTS

D. M. Denison London, Flying Personnel Res. Comm., Jan. 1965 31 p refs

(FPRC/MEMO-217) CFSTI: HC $2.00/MF $0.50

This article discusses the fire risks of experiments to be conducted in a high performance decompression chamber to study the effects of oxygen rich environments on the human respiratory system. The sources of fire risk are detailed and the methods of reducing it are described. There is a small but definite chance that physiological equipment close to the man may be ignited by a local electrical fault which could set fire to the man. There is a more remote risk of fire occurring in the environment conditioning loop or in the vacuum pumps. Either would be confined to the source of origin and could be extinguished by conventional methods. There is no danger of a general conflagration. If a fire occurs within a compartment, whether or not it sets fire to the man, a water sprinkler system will rapidly extinguish it. Subjects should be out of the chamber within one minute of a fire being detected. There still remains a small chance of setting fire to the man even if the procedures outlined are followed. The appendix includes a note on inflammability tests of materials in 100% oxygen. R.N.A.

N66-29357*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LIPID AND GLYCOGEN RESERVES IN HUMANS DURING PROLONGED WORK

R. Pelligra, D. R. Young, R. A. Adachi, G. A. Brooksby, and J. R. Debro [1964] 21 p refs Submitted for Publication

(NASA-TM-X-56762) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Experiments were conducted in which the responses of nonesterified fatty acids (NEFA) and glucose to insulin and epinephrine were used to qualitatively assess the state of body fat and carbohydrate reserves during prolonged exercise. Intravenous insulin (0.05 units/kg) administered to normal fasting humans after 8 hr of aerobic treadmill work caused a precipitous drop in mean serum glucose and NEFA levels to 41 mg/100 ml and 0.994 meq/l, respectively. Subjects were able to continue walking despite signs and symptoms of severe hypoglycemia and glucose and NEFA returned to preinjection levels within 3 hr. Intramuscular epinephrine (0.10 mg/kg) caused a significant rise in serum glucose, but NEFA values were relatively unaffected as compared to resting controls. Indications are that at the time of injection, (a) liver glycogen stores were significantly lower in the working than in the resting group, but were not depleted to the extent anticipated following a 2500 kcal energy expenditure and 21 hr of fasting, and (b) NEFA were being mobilized from adipose tissue at a maximum rate. Possible mechanisms regulating the availability of energy from fat depots are briefly discussed. Author

N66-29361*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF RADIOSENSITIVITY IN VARIOUS STRAINS OF *DROSOPHILA MELANOGASTER* [SRAVNITEL'NOYE IZUCHENIYE RADIOCHUVSTVITEL'NOSTI RAZLICHNYKH LINIY *DROSOPHILA MELANOGASTER*]

I. Ye. Vorobtsova Apr. 1964 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 153, no. 4, 1963 p 943–946

(NASA-TT-F-8840) CFSTI: HC $1.00/MF $0.50 CSCL 06C

This report presents the results of a comparative study of radioresistance in seven strains of wild-type *Drosophila melanogaster*. Five to six day old males were exposed to a 100 kr dose using a RUM-7 apparatus. Following exposure, the flies were kept at 25°C, their nutrient medium changed every other day, and dead individuals counted daily until the last fly died. A control was run simultaneously with the experiment. The mean survival time and number of flies that died each day served as indicators of radioresistance. Interstrain differences in radiosensitivity were found. A high positive correlation was discovered in all the strains between general radiosensitivity and rate at which the flies died during the first post-exposure period. This makes it possible to shorten the length of the observation period needed for objective evaluation of the relative radiosensitivity of the strains. The method of evaluating radiosensitivity from the death rate of individuals during the first post-exposure period may be more accurate than the method involving determination of the mean survival time, because the shorter observation period limits the possibility of distortions due to external factors. R.N.A.

N66-29379*# Stanford Univ., Calif. Biophysics Lab.

MOLECULAR EVOLUTION IN PROTOBIOLOGICAL SYSTEMS Final Report, Dec. 1, 1961–Nov. 30, 1964

M. S. Blois, Jr. and H. H. Pattee Mar. 1965 18 p refs (Grant NsG-218-62)

(NASA-CR-62532; BL-136) CFSTI: HC $1.00/MF $0.50 CSCL 06A

The titles of a number of papers concerning experimental and theoretical work in the field of molecular evolution are listed: (1) *Pi-electron Photochemistry of DL-phenylalanine in Oxygen Saturated and Oxygen Free Solutions*, (2) *Random Polymers as a Matrix for Chemical Evolution*, (3) *The Optical and Photochemical Properties of Melanins*, (4) *Photochemistry of DL-phenylalanine*, (5) *Experimental Approaches to the Origin of Life Problem*, and (6) *A Note on Chemical and Hereditary Evolution*. The last two papers are presented here in detail. In addition, a number of Miller type experiments concerning molecular evolution in protobiological systems are cited. These involved arc discharge experiments with various irradiated mixtures of simple organic and inorganic compounds, with IR and UV spectrums of the resulting products for identification purposes. Results are discussed. L.S.

N66-29421*# Joint Publications Research Service, Washington, D. C.

STUDIES ON THE SECOND PHASE OF NYSTAGMUS

A. Noto Washington, NASA, Oct. 1963 42 p refs Transl. into ENGLISH from Nippon Jibiinkoka Gakkai Kaiho (Japan) p 40–53

(NASA Order W-11577-B-81)

(NASA-TT-F-8538) CFSTI: HC $2.00/MF $0.50 CSCL 06

Experiments were carried out on the secondary phase of nystagmus using healthy persons and rabbits. The following conclusions were obtained: (1) The secondary phase is a basic pattern of the nystagmus reaction common to

rotatory, caloric, and optokinetic nystagmus. (2) The second phase is a function of the basic reflex arc of the nystagmus reaction and is regulated by the higher control pathways involving the cerebrum and cerebellum. Author

N66-29443*# United Aircraft Corp., Windsor Locks, Conn. Space and Life Systems Dept.

STATISTICAL DECISION PROBLEMS IN LARGE SCALE BIOLOGICAL EXPERIMENTS Final Report

D. R. Hitchcock and G. B. Thomas 31 Mar. 1965 148 p (Contract NASw-871)

(NASA-CR-57677; SLS-5305R) CFSTI: HC $4.00/MF $1.00 CSCL 06C

This study is concerned with the application of decision theory techniques to the design of biological experiments characterized by high cost, a relatively high degree of uncertainty about the correct functioning of the observational equipment, and a relative lack of antecedent information regarding the probable space–time distributions of the properties or property to be observed. Included are discussions of the decision theory approach to selecting extraterrestrial life detection strategy, reliability and error control, computer simulations of growth and metabolism experiments, bandwidth requirements, problems involving the design and management of spacecraft sterilization procedures, analysis of evaluation problems associated with visual reconnaissance experiments, and statistical measures of life likeness. R.N.A.

N66-29464*# Medical Coll. of Virginia, Richmond. Radiation Physics Div.

INVESTIGATION OF TOTAL ENERGY ABSORPTION IN OMNIDIRECTIONAL GAMMA-RAY, BRENSSTRAHLUNG AND NEUTRON FLUXES Status Report No. 2, 1 Jun. 1965–28 Feb. 1966

Fearghus T. O'Foghludha 28 Mar. 1966 38 p refs (Grant NGR-47-002-004)

(NASA-CR-75884) CFSTI: HC $2.00/MF $0.50 CSCL 06R

Spectral measurements, chemical investigations, and irradiation studies to investigate total energy absorption in omnidirectional gamma rays are reported. Efforts to obtain a response matrix are described in light of a modified 400-channel analyzer and set of calibration spectra. Chemical investigations were restricted to modified ferrous–ferric systems, another variant using benzoic acid stabilization, and an aqueous benzene system. Phantom mounting and speed programming are mentioned in relation to omnidirectional irradiation. Additional investigations were made on E-detectors, Geiger–Mueller probes, comparison chambers, anthracene detectors, and scatter integrals. S.P.

N66-29472*# National Aeronautics and Space Administration, Washington, D. C.

FORMATION OF PROPROTEIN AND THERMAL THEORY POLYCONDENSATION OF FREE AMINO ACID

Kaoru Harada (Florida State Univ.) Sep. 1963 26 p refs Transl. into ENGLISH from Tampakushitsu Kakusan Koso (Tokyo), v. 6, 1961 p 65–75 Contrib. No. 142 of the Oceanographic Inst., Florida State Univ.

(NASA-TT-F-8429) CFSTI: HC $2.00/MF $0.50 CSCL 06A

The formation of proproteins (amino acids) and the thermal theory of the polycondensation of free amino acids are reviewed. Amino acids could have been synthesized from a reducing atmosphere composed of methane, ammonia, hydrogen, and water vapor by such energy sources as lightning, ultraviolet radiation, and radioactivity. Thermal energy does not appear to be an effective energy source for the synthesis of amino acids. It is indicated that the thermal synthesis of copolymers of all of the amino acids found in nature should be possible, in the presence of an excess of glutamic acid and aspartic acid. However, the acidic amino acids are the key "elements" in the thermal polycondensation process. It may be said that ultraviolet radiation and lightning would probably have been more efficient in the formation of amino acids, with thermal energy playing a secondary role. However, based on knowledge of the thermal polycondensation mechanism for polyamino acid synthesis, thermal energy would be the most efficient energy source for protenoid (a primitive protein) synthesis. I.v.L.

N66-29639# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

THE EFFECT OF THE INVERTED POSTURE UPON THE DISTRIBUTION OF PULMONARY BLOOD FLOW WITHIN THE LUNGS

D. M. Denison, J. Ernsting, D. I. Fryer, and A. B. Pignatelli London, Flying Personnel Res. Comm., Sep. 1964 21 p refs (FPRC/1229) CFSTI: HC $1.00/MF $0.50

The distribution of alveolar ventillation and of pulmonary blood flow were studied using radioactive xenon in four subjects while seated upright and hanging head down. Inversion reduced the inequality of the distribution of alveolar ventilation between the apical and basal regions of the lung. In the upright position, the ratio of apical to basal blood flow averaged 1:2.5 whereas in the inverted position the mean ratio was 1:0.61. Thus, hanging head down reversed the normal distribution of the pulmonary blood flow, the basal regions receiving considerably less blood than the apical region in this posture. These results demonstrate the marked effect of gravity upon pulmonary circulation. Author

N66-29670*# Michigan Univ., Ann Arbor. Dept. of Psychology.

BRAIN CENTERS AND POSITIVE REINFORCEMENT

James Olds [1963] 81 p refs Presented at the 27th Intern. Congr. of Psychology, Washington, Aug. 1963 Submitted for Publication

(Grant NsG-626)

(NASA-CR-75898) CFSTI: HC $3.00/MF $0.75 CSCL 06J

Research conducted on positive reinforcement produced by electric stimulation of the brain is discussed. The term positive reinforcement is defined, and some results of earlier experiments conducted in this area are given. Research continued to determine the responses when electrodes were placed in various parts of the brain. It was determined that electrical stimulation in a broad set of brain areas yielded effects on behavior tantamount to primary reward. The areas involved were largely in the hypothalamus and the rhinencephalon. With the current correctly adjusted and the electrodes correctly placed, it was possible to generate more motive force with this type of reward than any other reward used in animal experimentation. In addition to areas where stimulation yielded positively rewarding effects, it was determined that there were other areas in the brain where stimulation yielded negatively reinforcing primary-punishing effects. Also, a third set of placements was found where stimulation seemed to yield both effects equally. Additional results are given and the implications of these results are assessed. H.S.W.

N66-29574*# Naval School of Aviation Medicine, Pensacola, Fla.

THE THOUSAND AVIATOR STUDY: SMOKING HISTORY CORRELATES OF SELECTED PHYSIOLOGICAL, BIOCHEMICAL, AND ANTHROPOMETRIC MEASURES

Norman E. Lane, Albert Oberman, Robert E. Mitchell, and Ashton Graybiel 27 Apr. 1966 20 p refs

(NASA Order R-136)

(NASA-CR-75902; NAMI-961) CFSTI: HC $1.00/MF $0.50 CSCL 06P

During the 1963 follow-up examination in the Pensacola Thousand Aviator Study, smoking history information was obtained by questionnaire on 675 subjects. Concurrent data were collected from clinical examinations, laboratory tests, anthropometry, and personal history variables. Two smoking variables were created, Cigarette Amount (CA) and Cigarette Years (CY), each on a scale of 1 to 5 points. From the concurrent data, 62 variables were selected for relevance and general interest to be examined in relation to smoking. Twenty-four of the 62 variables had significant correlations ($p<.05$) with CA, and 16 showed significant relationships to CY. Findings are related briefly to previous research, and problems of cause-effect isolation are mentioned. It is concluded that results in general support previous findings on smoker-nonsmoker differences. Contributions of the study in delineating areas of research for longitudinal investigation are discussed. Author

N66-29577# Atomic Energy Commission, Washington, D. C. Div. of Biology and Medicine.

RADIOACTIVE FALLOUT FROM NUCLEAR WEAPONS TESTS. PROCEEDINGS OF THE SECOND CONFERENCE

Alfred W. Klement, Jr., ed. Oak Ridge, Tenn., AEC, Nov. 1965 965 p refs Conf. held in Germantown, Md., 3-6 Nov. 1964 *Its* AEC Symp. Ser. No. 5

(CONF-765) CFSTI: HC $6.50/MF $3.75

Fifty-seven articles are included on: physical, chemical, and radiological characteristics of atmospheric radioactivity and fallout; long-term particle behavior; local atmospheric transport; global atmospheric transport; and distribution and cycling of radionuclides. NSA

N66-29592# Wisconsin Alumni Research Foundation, Madison.

SURVEY OF EXISTING METHODS OF FEEDING AND HOUSING THE CHIMPANZEE Final Report, Jun. 1963-May 1965

Paul O. Nees and Philip H. Dorse Holloman AFB, N. Mex., Aeromedical Res. Lab., Aug. 1965 38 p refs

(Contract AF 33(657)-11348)

(ARL-TR-65-11; AD-625101) CFSTI: HC $2.00/MF $0.50

Background information concerning feeding, housing and handling of the chimpanzee was obtained during visits to major zoological parks and several laboratories maintaining chimpanzees. Information on the habits of the chimpanzee in the wild was obtained and where applicable, this knowledge was used to better understand some of the problems involved in maintaining caged chimpanzees for laboratory purposes. A movable cage with feeder and water was designed to hold chimpanzees from 2 to 6 years old. Methods of handling employing negative and positive reward methods were compared. Diets were compared and revealed zoological parks generally fed a ration of fresh fruits and vegetables with cooked cereals and milk and small quantities of commercial chimp biscuits. Laboratories generally fed the commercial chimp biscuits supplemented with small quantities of fresh fruit and vegetables. Author (TAB)

N66-29593# Naval Radiological Defense Lab., San Francisco, Calif.

ENDOTOXIN-PROTECTION OF MICE—THE RELATIONSHIP TO COLONY-FORMING UNITS

Gerald E. Hanks (Stanford Univ., Palo Alto, Calif.) and E. John Ainsworth 21 Dec. 1965 44 p refs

(USNRDL-TR-957; AD-630338) CFSTI: HC $4.60/MF $0.50

Earlier studies have shown that bacterial endotoxins increase survival of irradiated animals. Although these substances do not confer as much protection as do the classical chemical protectants, endotoxins do significantly increase survival when given either before or for a short time following irradiation. The mechanisms of endotoxin protection have not been clearly established, but earlier studies have shown that hematopoietic stimulation is involved. The present studies were designed to evaluate the effects of endotoxin on proliferative cells in the hematopoietic system. Methods have recently been devised to measure the numbers of certain proliferative cells within the bone marrow, spleen, and other hematopoietic sites. These proliferative cells are called colony-forming units (CFU's), and their numbers are estimated by counting the 'colonies' or nodules in the spleens of irradiated mice which arise either 'spontaneously' or after injection of hematopoietic cells. The present data indicate that endotoxin does not alter the radiosensitivity of endogenous splenic CFU's; the D37 for CFU's is approx. 90 R in both endotoxin-treated and control mice. When endotoxin is injected at the time which produces optimal survival, the femur content of CFU's increases approx. 2 fold; whereas, the spleen content of CFU's is increased approx. 20 fold. The increased rate of CFU's migration from the femur to the spleen in endotoxin-treated animals may contribute to the relatively greater increase in splenic CFU's. Author (TAB)

N66-29597# Naval Radiological Defense Lab., San Francisco, Calif.

COMPARISON OF DOSE PATTERNS IN A DOG EXPOSED TO NEUTRONS AND TO X-RAYS

Catharine L. Wingate, Norbert P. Page, and E. John Ainsworth 7 Feb. 1966 28 p refs

(USNRDL-TR-974; AD-630332) CFSTI: HC $2.00/MF $0.50

Dose distributions with depth in a dog cadaver and in a cylindrical phantom have been obtained for 1 Mvp transmitted X-rays and for mixed neutron and gamma radiation from a reactor. The ratio of neutron to gamma dose was 4:1 at the surface of the dog. Measurement of the gamma or X-ray dose was made using LiF thermoluminescence dosimeters, while neutron dose was obtained from the activation of small sulfur pellets, with suitable calibrations. Placement of dosimeters was verified by roentgenography. Penetration of the 1 Mvp X-rays is considerably higher than that of the reactor neutrons, whose effective energy is about 1 Mev, and does not appear to differ significantly in various cross sections of the body as was found for 250 Kvp X-rays by others. For the reactor beam administered unilaterally the energy deposition in the dog is strongly asymmetric as shown by isodose configurations for the neutron and gamma components. However, only minor variations were found in the depth dose curves for the phantom and different sections through the dog cadaver, namely, head, chest and abdomen, in spite of the differences in composition and density. Author (TAB)

N66-29663*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-1, CARDIOVASCULAR CONDITIONING

Lawrence F. Dietlein and William V. Judy *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 381–391 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Data are presented on ground baseline studies in support of the cardiovascular conditioning experiments which indicated that leg cuffs alone, when inflated to 70 to 75 millimeters of mercury for two out of every six minutes, provided protection against cardiovascular deconditioning occasioned by six hours of water immersion. In the M-1 experiments, flown on the Gemini V and VII missions, the pilots served as experimental subjects; the command pilots as controls. The equipment consisted of a pneumatic timing or cycling system, and a pair of venous pressure cuffs attached to the pilots' thighs. Prior to the missions, each crew member was given a series of tilt-table tests; similar postflight tests were also conducted. Results are summarized for pulse rate changes, blood pressure readings, and changes in leg blood volume, intravascular volume, and nude body weights. Based on the preflight and postflight data, it was concluded that the pulsatile cuffs were not effective in lessening postflight orthostatic intolerance. However, the cuffs appeared to be effective in lessening the degree of postflight pooling of blood in the lower extremities as judged by the strain gauge technique.

M.G.J.

N66-29665*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-4, INFLIGHT PHONOCARDIOGRAM—MEASUREMENTS OF THE DURATION OF THE CARDIAC CYCLE AND ITS PHASES DURING THE ORBITAL FLIGHT OF GEMINI V

Lawrence F. Dietlein and Carlos Vallbona (Baylor Univ.) *In its* Gemini Midprogram Conf. including Expt. Results 1966 p 397–402 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Simultaneous electrocardiographic and phonocardiographic records were obtained from both Gemini V crewmembers. Analysis of these data revealed: (1) wide fluctuations of the duration of the cardiac cycle within physiological limits throughout the mission; (2) fluctuations in the duration of electromechanical systole that correlated with changes in heart rate; (3) stable values for electromechanical delay (onset of QRS to onset of first heart sound) throughout the mission, with shorter values observed at the peak heart rates recorded during lift-off and reentry; (4) higher values for the duration of systole and for electromechanical delay in the command pilot than in the pilot, suggesting preponderance of cholinergic influences (vagal tone) in the command pilot; and (5) evidence of adrenergic reaction (sympathetic tone) at lift-off, at reentry, and in the few hours that preceded reentry. Author

N66-29666*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-5, BIOASSAYS OF BODY FLUIDS

Lawrence F. Dietlein and E. Harris *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 403–406 refs (see N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Experiments were conducted to determine the effect of space flight on several systems of the human body, and particularly those areas where effects can be observed by alterations in the chemistries of body fluids. Plasma and urine samples were analyzed before flight to obtain baseline data; during flight a urine-sampling and volume-measuring system was used to obtain the total voided volumes. Postflight plasma samples were obtained immediately upon recovery. Analytic procedures are listed, and plasma and urine analyses of the Gemini VII crew are given. Preflight and postflight data indicate that the electrolyte and water retention observed immediately after recovery are consistent with the assumption that the Gauer–Henry atrial reflex is responsive to a change from the weightless to the 1 g environment. Alterations in electrolyte and water distribution during flight may also be contributory. Immediately postflight, plasma 17-hydroxycorticosteroid levels were elevated. Plasma uric acid was reduced, and the cause was presumed to be dietary. M.G.J.

N66-29667*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-6, BONE DEMINERALIZATION

Pauline Berry Mack, George P. Vose, Fred B. Vogt (Texas Womens Univ.), and Paul A. La Chance *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 407–415 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A series of investigations on bone demineralization were conducted to determine the effect upon the human skeletal system of prolonged weightlessness and immobilization associated with confinement for a period of days in the Gemini spacecraft. To evaluate any changes, radiographic bone densitometry measurements were taken. It was found that the crews of Gemini VII experienced lower losses in the os calcis than were found in the crews of Gemini IV and V. In assessing these results, it is stated that the crew members of Gemini VII ate a higher proportion of their diet than the crews of Gemini IV and V. Additionally, the crew had isometric and isotonic exercises, and they slept for longer periods of time. The data obtained from preflight tests are compared to the post-flight results, and recommendations for further study are made.

H.S.W.

N66-29668*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-7, CALCIUM AND NITROGEN BALANCE

G. D. Whedon (Natl. Inst. of Health), Leo Lutwak (Cornell Univ.), William F. Neuman (Rochester Univ.), and Paul A. La Chance *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 417–421 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Procedural details are given on a metabolic-balance study undertaken to observe the biochemical changes occurring as a result of several complex, interrelated influences—principally weightlessness, confinement, moderate physical movement, slight hyperoxia, and low atmospheric pressure. The experiment involved precise control of the dietary intake and the collection and analysis of all excreta in order to obtain a quantitative determination of the extent of change in the principal inorganic constituents of these systems. It also required complete and continuous data on the dietary intake of the Gemini VII crew, and continuous collection of all urine and stool specimens before, during, and after the flight. Perspiration was also collected during representative periods before and after flight, and continuously during flight, to determine excretion of various elements such as calcium. Sample menus are included, and details are given on methods devised for specimen collection. M.G.J.

N66-29669*# Baylor Univ., Houston, Tex. Medical Center.

EXPERIMENT M-8, INFLIGHT SLEEP ANALYSIS

Peter Kelloway *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 423–429 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The feasibility of analyzing sleep by EEG was demonstrated during this experiment. The periods of sleep of the command pilot of Gemini VII were recorded using a helmet-on electrode system arrangement. By comparing the EEG recordings made at a ground based laboratory prior to the flight with the recordings made while in space, it was possible to distinguish between the four levels of sleep; ranging from drifting or drowsiness to the rapid eye movement stage of sleep. Data in the form of sample EEG recordings are included, and a discussion which explains and assesses the importance of these data is included. H.S.W.

N66-29670*# Naval School of Aviation Medicine, Pensacola, Fla.

EXPERIMENT M-9, HUMAN OTOLITH FUNCTION

Earl Miller *In* NASA. Manned Spacecraft Center Gemini Mid-program Conf. Including Expt. Results 1966 p 431-436 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The completion of the otolith function experiment carried out in conjunction with the Gemini V and VII flights provided quantitative information concerning otolithic sensitivity and orientation of subjects exposed to an orbiting spacecraft environment for prolonged periods of time. Three separate preflight measurements of ocular counterrolling were made and the results were compared to postflight measurements. There existed a marked difference between the two crews with regard to their basic response; however each pilot maintained his respective preflight level of response. These data indicated that a coordinate space sense exists in weightlessness, however, it was also determined that the apparent location of the horizontal within the spacecraft may not necessarily agree with its physical correlate in the spacecraft. The data obtained from these tests are shown in graphs, and a discussion of these data is included. H.S.W.

N66-29677# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.

ADAPTATION TO EXTREME ENVIRONMENTS: THE ANTARCTIC VOLUNTEER

E. K. Eric Gunderson Mar. 1966 32 p refs

(Rept.-66-4; AD-632571) CFSTI: HC $2.00/MF $0.50

The report described the Antarctic research program, the Antarctic environment, characteristics of small stations, and the composition of wintering over parties. Demographic and biographic characteristics of Antarctic volunteers, Navy and civilian, were analyzed, and preenlistment histories and military performance records of Navy Antarctic volunteers were compared with those of Navy men generally. The selection process was portrayed for Navy occupations represented at small stations, and ratios of applicants to assignments for three expeditions were presented. A detailed analysis was conducted of cultural and psychological differences among antarctic occupational groups. The data were intended to present a rather complete picture of the Antarctic setting and the characteristics of Antarctic volunteers. Author (TAB)

N66-29686# Naval Radiological Defense Lab., San Francisco, Calif.

^{59}Fe INCORPORATION INTO SPLEEN AND BONE MARROW OF INTACT AND SPLENECTOMISED X-IRRADIATED MICE RESTORED WITH SPLEEN COLONY CELLS

Raymond Schofield and Leonard J. Cole 11 Mar. 1966 15 p refs

(USNRDL-TR-969; AD-632049) CFSTI: HC $1.00/MF $0.50

Cells from haemopoietic tissues when injected into lethally-irradiated mice induce survival and restoration of the animals, whether they are intact or splenectomised. But cells derived from haemopoietic nodules (which occur in spleens of heavily irradiated mice injected with bone marrow cells) when injected into lethally irradiated mice result in different effects in intact mice than in splenectomised ones. In the former the anaemia resulting from irradiation is corrected within 25 days, whereas in splenectomised mice the anaemia which develops is much more severe and persists for up to 80 days after irradiation. The course of cellular repopulation of bone marrow in splenectomised mice irradiated with 900 rad and injected with spleen-nodule cells has been compared with that in intact mice treated in the same way. No differences were seen, indicating that the absence of the spleen did not have an effect on the repopulation. In order to assess the erythropoietic activity of total body bone marrow, to enable this to be compared with the erythropoietic activity of spleen, determination of ^{59}Fe in whole cleaned mouse skeletons was carried out. The results show that in the mouse the two femora account for 13-15% of the total skeletal content of ^{59}Fe at 5 hours after injection of the label. Author (TAB)

N66-29701# Naval Radiological Defense Lab., San Francisco, Calif.

DIFFERENTIAL SENSITIVITY OF CIRCULATING AND PERITONEAL MONONUCLEAR CELLS OF MICE TO TOTAL-BODY X-IRRADIATION

Lottie Kornfeld and Vivian Greenman 21 Mar. 1966 18 p refs

(USNRDL-TR-999; AD-632282) CFSTI: HC $1.00/MF $0.50

Dose-response curves obtained 1 and 3 days after exposure to total-body X-irradiation indicate that the mononuclear cells in the circulating blood and in the peritoneal cavity of LAF_1 mice may be arranged in the following order of decreasing sensitivity: circulating lymphocytes, small peritoneal lymphocytes, medium peritoneal lymphocytes, peritoneal macrophages. However, on the 3rd day postirradiation, the curve of the small peritoneal lymphocytes closely approached that of the circulating lymphocytes. It is suggested that the greater sensitivity to irradiation of small than of medium peritoneal lymphocytes is not due to environmental factors but to as yet unidentified differences in the cells. On the other hand, the greater loss of circulating lymphocytes than of small peritoneal lymphocytes 1 day after X-ray exposure may merely reflect more efficient removal of damaged cells from the circulation than from the peritoneal cavity. Author (TAB)

N66-29706*# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.

PHOTOINHIBITION OF CHLOROPLAST REACTIONS. I: KINETICS AND ACTION SPECTRA

L. W. Jones and B. Kok [1966] 34 p refs Submitted for Publication

(Contracts NASw-747; AF 41(609)-2369)

(NASA-CR-75984) CFSTI: HC $2.00/MF $0.50 CSCL 06A

A study was made of photoinhibition of chloroplast reaction. Besides other features of the process, we analyzed its kinetics and spectral characteristics over a range between 200 and 700 mμ. (2) Irrespective of wavelength, the decline of activity due to preillumination was found to be dependent upon the number of quanta applied, not upon the rate of application. (3) The effectiveness spectra of photoinhibition indicate that active ultraviolet light is absorbed by pigment which is not a normal light absorber for photosynthesis and acts with a high quantum efficiency (<10

(4) Active visible light is absorbed by the pigments which sensitize photosynthesis (chlorophyll, carotenoids) and acts with a very low quantum efficiency (about 10^4). (5) The action spectrum of the photoinhibition of dye reduction by chloroplasts and lyophylized Anacystis cells indicated that the damage caused by visible light is due to quanta absorbed by photosystem II. However, dye reduction may reflect only damage to photosystem II. Author

N66-29723*# National Aeronautics and Space Administration, Washington, D. C.

PERCEPTION OF CERTAIN MECHANICAL QUANTITIES INHERENT TO THE ANIMAL ORGANISM [VOSPRIYATIYE NEKOTORYKH MEKHANICHESKIKH VELICHIN, SVOYSTYENNOYE ORGANIZMU ZHIVOTNOGO]

O. G. Gazenko and N. A. Chekhonadskiy May 1966 17 p refs Transl. into ENGLISH from Avtometriya (USSR), no. 2, 1965 p 11–17

(NASA-TT-F-10138) CFSTI: HC $1.00/MF $0.50 CSCL 06P

The properties of an elementary model of the otolithic portion of the vestibular apparatus, explaining a number of functions of this important organ, are examined. The principles of measuring a number of mechanical parameters necessary for control and coordination of movements are hypothesized on the basis of analyzing the experimental materials and properties of the model, in analogy with data-processing systems for conversion of analog to digital data. Orientation in space, upon deflection of the head from the vertical, and under accelaration, is discussed on the basis of function of the receptor–neuron circuits of the otolithic apparatus. Author

N66-29724*# National Aeronautics and Space Administration, Washington, D. C.

INFLUENCE OF LOW TEMPERATURES ON THE DEVELOPMENT OF MICROORGANISMS. III: INFLUENCE OF LOW TEMPERATURES ON THE DEVELOPMENT OF BACTERIA AND YEASTS [VLIYANIYE NIZKIKH TEMPERATUR NA RAZVITIYE MIKROORGANIZMOV. III: VLIYANIYE NIZKIKH TEMPERATUR NA RAZVITIYE BAKTERIY I DROZHZHEY]

F. M. Chistyakov and G. L. Noskova May 1966 23 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 7, no. 5, 1938 p 565–578

(NASA-TT-F-10142) CFSTI: HC $1.00/MF $0.50 CSCL 06M

The Pseudomonas, Flavobacterium and Achromobacter group of bacteria and some micrococci are capable of developing at low temperature: Bact. putidum and Achromobacter sp. develop at −2°; Bact. fluorescens, Flavobacterium flavescens, Flavobacterium ochraceum, Flavobacterium sp., and Micrococcus sp. increase at −5°, and Flavobacterium sulfureum and Bact. lactis viscosum can multiply even at −8°. The other groups of bacteria, including those of the paratyphoid group and B. botulinus, do not develop at a temperature above +2°. Thus the minimum temperature required for bacterial development is determined by the group to which the particular bacteria belong. The lowest temperature at which yeast can develop is about −8°. The microorganisms not resistant to cold, gradually die off at low temperature, in some cases rather slowly. The spore-forming types of bacteria are more resistant to cold. The addition of salt to the nutritive media lowers the bacteria's resistance to cold. Author

N66-29750*# Naval School of Aviation Medicine, Pensacola, Fla.

BIOCHEMICAL CHANGES OCCURRING WITH ADAPTATION TO ACCELERATIVE FORCES DURING ROTATION

James K. Colehour and Ashton Graybiel Apr. 1966 18 p refs (NASA Order R-93)

(NASA-CR-76042; NAMI-959) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Four young men lived in a continually rotating room, 15 feet in diameter, for a period of six days. Rotational velocities on succeeding days were: 6.4, 6.4, 8.6, 10.0, 6.4, and 3.2 RPM. Stress effects measured as increased excretion rates of 17,21 dihydroxypregnane-20-ones, eosinopenia, hyperventilation, and nausea were observed on the first day of rotation. However, adaptation was rapid, and no further stress effects were observed even with increased rotational velocity. Mild degrees of hypercalciuria, hypercapnia, and decreased norepinephrine excretion rates were observed during the last four days of the experiment as a result of the increased time spent in recumbency. Author

N66-29752*# Naval School of Aviation Medicine, Pensacola, Fla.

A NOTE ON THE DOSIMETRIC INTERPRETATION OF RIGIDITY SPECTRA FOR SOLAR PARTICLE BEAMS

Hermann J. Schaefer 26 Apr. 1966 20 p refs (NASA Order R-75)

(NASA-CR-76044; NAMI-960) CFSTI: HC $1.00/MF $0.50 CSCL 06R

Three flux/rigidity spectra were established theoretically covering the full variability range of all flare events of the past solar cycle and are evaluated dosimetrically. It was found that, of the components heavier than protons, only alpha particles contribute substantially to total exposure. The fractional alpha dose in the tissue surface behind 0.1 g/cm^2 shielding grows from 40 percent for P_o=50 Mv to 400 percent for P_o=300 Mv. The alpha dose shows a much steeper drop with increasing depth than the proton dose and would require microsensors for accurate measurement. For the alpha and medium heavy components, the RBE shows a pronounced transition in near surface regions which further steepens the drop of RBE dose equivalents as compared to rad doses. The extremely strong and nonlinear dependence of the rad and rem dose distribution on rigidity sharply limits the usefulness of the rigidity concept for dosimetric evaluations and indicates the need for direct measurements of local rad and rem doses on the astronaut's body. Author (TAB)

N66-29754*# Naval School of Aviation Medicine, Pensacola, Fla.

A STANDARD TECHNIQUE FOR TEMPORAL BONE PREPARATION

Makoto Igarashi 2 Mar. 1966 53 p refs *Its* Monograph 13 (NASA Order R-93)

(NASA-CR-76048) CFSTI: HC $3.00/MF $0.50 CSCL 06E

This monograph is intended as a guide in the preparation of good temporal bone slides which will make it possible to investigate the correlation between end organ functions and morphological findings. The techniques described herein have been found to render the most consistently satisfactory temporal bone preparations. Author

N66-29815# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HISTOMORPHOLOGICAL CHANGES IN THE INTERNAL EAR OF DOGS UNDER THE EFFECT OF RADIAL ACCELERATIONS

S. S. Markaryan and R. Ye. Kogan 17 Mar. 1966 13 p refs Transl. into ENGLISH from Vestn. Otorinolaringol. (Moscow), no. 2, 1964 p 17–21
(FTD-TT-65-1356/1+2+4; TT-66-60995; AD-631991) CFSTI: HC $1.60/MF $0.50

Twelve dogs were subjected to the action of accelerations within the limits of 2.4–14.5g, the time ranging from 4 to 20 minutes. In the internal ear of dogs, the venous circulation became disturbed, this resulting in protracted hemorrhages in the perilymphatic spaces of the cochlea and subepithelial connective tissue of sace and ampules. Hemorrhages in the internal ear resolved much slower than hemorrhages occurring in the middle ear or in the internal acoustic meatus.
Author (TAB)

N66-29837# National Univ. of Ireland, Dublin. Unit of Cell Metabolism.
ACTIVE TRANSPORT OF IONS Final Scientific Report
Edward J. Conway 27 Feb. 1966 4 p
(Contract AF 61(052)-852)
(AFOSR-66-0717; AD-632305) CFSTI: HC $1.00/MF $0.50

Research studies conducted to examine the concept of the critical energy barrier as applied to isolated frog muscles loaded with sodium are summarized. The physiological K-carrier in yeast is identified as the most important finding in relation to the active transport of ions. It is pointed out that the system in yeast concerned with the active transport of potassium is contained in the yeast cell walls; at a pH of about 7 this physiological K-carrier can actively transport any inorganic ion, provided it is present in sufficient concentration outside (about 0.2 M). However, it transports inorganic ions at different rates, depending on the affinity of the ion for the carrier. Two theories on the mechanism of this active transport, and the transference of an ion from a lower to a higher electrochemical potential with input of the necessary energy are discussed. Electron microscope examinations of three membrane barriers in frog skeletal muscles, with respect to sodium entrance at 0° to 4°C in the absence of external potassium, are also reported.
M.G.J.

N66-29877# Joint Publications Research Service, Washington, D. C.
SOME EFFECTS OF THE FLIGHT OF THE KOSMOS-110 ON THE TEST DOGS
V. Pravetskiy, N. Gurovskiy, B. Yegorov, and A. Kiselev 24 Jun. 1966 10 p Transl. into ENGLISH from Pravda (Moscow), 17 May 1966 p 6
(JPRS-36182; TT-66-32616) CFSTI: $1.00

Physiological data collected on the test dogs aboard the Kosmos 110 satellite, and the conclusions drawn from them concerning the effects of prolonged weightlessness are presented. (1) A significant decrease in the volume of muscular mass and disruption of coordination were observed. Preflight coordination level was not reattained until 8 to 10 days after return to earth. (2) A heightened calcium content was discovered in the urine and blood. (3) The marked thinness of the animals was felt to be caused by decrease in muscular mass and slight dehydration. (4) At the beginning of the flight abrupt fluctuations in the heart beat were noted; after 10 to 14 days the pulse dropped to a normal level. After the flight an increase was again noted, but by the fourth day on earth it returned to normal. (5) Several days after the flight a marked increase in the erythrocite sedimentation reaction and an increase in leucocytes were noted. It was concluded that this was a reaction to normal gravity conditions after weightlessness. (6) Changes evidenced in the fermentation function of the intestines ceased 6 or 7 days after the flight and were felt to be associated with change from space to normal diet.
L.E.W.

N66-29878# Joint Publications Research Service, Washington, D. C.
STUDIES ON WORK FITNESS AND WORK ARRANGEMENTS
P. A. Makkaveyskiy 23 Jun. 1966 25 p refs Transl. into ENGLISH from Ekspertiza Trudosposobnosti i Trudoustroystvo pri Nervynykh i Psikhicheskikh Zabolevaniyakh (Leningrad), 1965 p 5–17, 121–127
(JPRS-36164; TT-66-32598) CFSTI: $2.00

The problems involved in reducing and preventing the disability associated with nervous disorders are examined, in relation to the preservation and proper utilization of manpower resources and the impact of such disabilities on the Soviet social system. The medical evaluation program is discussed, and recommendations for implementing it are proposed. These include early diagnosis and treatment, clinical observation and proper work arrangements for chronic cases, and retraining to achieve functional rehabilitation. Statistical data are also presented on more than 300 persons who were exposed to protracted superhigh frequency electromagnetic radiation, ranging in intensity from 70 to 200 $\mu w/cm^2$ for six hours daily. Results indicate that chronic exposure may produce autonomic symptoms accompanied by diencephalic crises; however, the functional changes tend to disappear after appropriate treatment and transfer to other types of work.
M.G.J.

N66-29887# Cajal Inst., Madrid (Spain). Dept. of Biophysics.
NEURONAL PATTERNS ASSOCIATED WITH AFFECTIVE RESPONSES Final Scientific Report
A. Fernandez de Molina 28 Feb. 1966 9 p refs
(Grant AF-EOAR-65-55)
(AFOSR-66-0713; AD-632269) CFSTI: HC $1.00/MF $0.50

The distribution and properties of the mass responses generated in the basal telencephalon and diencephalon after electrical stimulation of the basolateral and medial amygdala were analyzed in cats anesthetized with chloralose. Two groups of fibers were found in the stria terminalis with a conduction velocity of 2.7–3.4 and 0.7–1 m/sec, respectively. Twenty five neuronal units were analyzed in the septum, anterior and dorsolateral hypothalamus and nucleus ventromedialis, the main emphasis being made on their firing patterns and temporal capabilities.
Author (TAB)

N66-29895# School of Aerospace Medicine, Brooks AFB, Tex.
THE PREPARATION OF PAROTID FLUID PROTEIN-FREE FILTRATES Final Report, Feb.–Jun. 1965
A. Stewart Windeler, Jr. and Ira L. Shannon Mar. 1966 11 p refs
(SAM-TR-66-25; AD-632509) CFSTI: HC $1.00/MF $0.50

The effectiveness of nine methods for precipitating protein in parotid fluid was investigated. Measurement was made of total nitrogen concentration and total protein concentration on the protein-free filtrates. Nitrogen measurements were performed by a semi-micro-Kjeldahl procedure and the proteins were measured by the Lowry method. Three methods were found to remove all of the protein: (1) An acetic acid in acetone method. (2) Somogyi's copper sulfate method. (3) Somogyi's barium hydroxide method. The two Somogyi methods removed uric acid in addition to the protein.
Author (TAB)

N66-29946# Systems Research Labs., Inc., Dayton, Ohio.
FREQUENCY ANALYSIS OF KOROTKOV BLOOD PRESSURE SOUNDS USING THE FOURIER TRANSFORM Final Report
Thomas Rauterkus, John F. Feltz, and Jay W. Fickes Brooks AFB, Tex., USAF School of Aerospace Medicine, Feb. 1966 53 p refs
(Contract AF 41(609)-2753)
(SAM-TR-66-8; AD-632483) CFSTI: HC $3.00/MF $0.50

The purpose of this investigation was to determine the frequency content of the sound signals (Korotkov sounds) obtained from the microphone located in the arm cuff of an automatic blood pressure measuring instrument. Korotkov sound recordings were made for five subjects in five experimental situations: rest, postexercise, passive tilting, centrifuge rides, and flights in NF-100 aircraft. The frequency analysis was performed by using a digital computer to obtain the Fourier transforms of the sound signals. The Fourier transforms were displayed on the computer oscilloscope and photographed. The photographs were then arranged in a number of rectangular arrays for convenient comparison of the frequency content of the Korotkov sounds as related to the several types of Korotkov sounds, experimental situations, and subjects. Initial study of the 240 average Fourier transforms contained in these arrays indicates no readily observable common characteristics except that most of the sound energy is almost always located below 50 cps.
Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-28543# Joint Publications Research Service, Washington, D. C.
CERTAIN MECHANISMS OF THE BRAIN PARTICIPATING IN IMPRESSIONING
N. A. Aladzhalova *In its* Studies in Biol. and Machine Memory, 24 May 1966 p 10-17 refs (See N66-28546 16-08) CFSTI: $2.00

Trends in the analysis of certain brain mechanisms participating in sensory stimulation, impressioning and memory processes are discussed. Figures portray brain cortex neurons, and intergrains between neuron and glial elements. A tentative hypothesis on brain memory is mentioned. Certain portions of the memory model were examined from which the following is formulated: (1) The paths of memory are numerous, united and divided by functional, regulated connections. (2) The memory response element is probable and modified by a number of factors, particularly the supple factor of threshold. (3) The role of the ionic layers emerges on the internal surfaces of the neuron-glia separation; these intergrains acquire guide positions for the circulation of impulses, and contribute to the organization of short-term memory. Long-term memory is proposed for the neuron coded on the molecular level in the numerous memory cells.
R.Ll.

N66-28662# Aircraft Armaments, Inc., Cockeysville, Md.
A STUDY OF TACTICAL DECISION MAKING BEHAVIOR Final Report, Nov. 1964-Nov. 1965
Robert G. Kinkade, Jerry S. Kidd, and Maurice P. Ranc Bedford, Mass., AFSC, Electron. Systems Div., Nov. 1965 85 p refs
(Contract AF 19(628)-4792)
(ESD-TR-66-61; AD-478769)

A study program was conducted to investigate tactical decision making behavior. One aspect of the program involved defining a conceptual view of tactical decision making behavior. The other aspect of the program consisted of performing five experiments related to the conceptual view. A conceptual view is not uniquely different from existing views. It represents a combination of concepts which have been described by other people. The view provides a framework for categorizing research findings and investigating the operations of a command post. The experiments concerned investigating the effect of feedback factors, situation factors and task factors on tactical decision making performance. An artificial task, placed in an Air Defense context, was used as a research vehicle in these experiments. The results of the experiments have implications for training tactical decision makers and for designing command-control systems. Author (TAB)

N66-28771*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ASTRONAUT TRAINING
Neil A. Armstrong *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 43-48 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

An overall picture is presented of the academic, survival, and operational training of astronauts for the Apollo mission. Environmental familiarization programs through the use of centrifuges and other simulator devices is discussed. Training equipment mentioned includes mission simulators, the Apollo part-task trainer, Lunar Excursion Module (LEM) simulators, and the Gemini translation and docking simulator. A brief discussion is included of training experience derived from the Gemini program.
M.W.R.

N66-28772*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ASTRONAUT TRAINING IN GEOSCIENCES
Ted H. Foss *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 49-52 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

A brief description is presented for a lecture series, laboratory sessions, and field trips for training astronauts to carry out the geological and geophysical experiments required by the Apollo mission. Lecture and laboratory sessions of Training Series I dealt with hand specimen identification of minerals and rocks, with emphasis on igneous rocks and their origin. The four field trips were to the Grand Canyon, Big Bend Marathon region of west Texas, Kitt Peak Observatory and Flagstaff area, and northern New Mexico.
M.W.R.

N66-28828# Istituto Nazionale di Ottica, Florence (Italy).
PROBLEMS RELATED TO VISUAL PERFORMANCE OF PILOTS Annual Summary Report, 1 Dec. 1964-30 Nov. 1965
Adriana Fiorentini and Lucia Ronchi 20 Dec. 1965 119 p refs
(Contract AF 61(052)-850)
(AD-630475) CFSTI: HC $4.00/MF $0.75

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N66-28827# Istituto Nazionale di Ottica, Florence (Italy).
OCULAR MOVEMENTS AND APPARENT MOVEMENTS DURING ATTEMPTED MONOCULAR FIXATION OF A POINT IN A DARK FIELD
Adriana Fiorentini *In its* Probl. Related to Visual Performance of Pilots 20 Dec. 1965 p 1–33 refs (See N66-28826 16-05) CFSTI: HC $4.00/MF $0.75

Motor and perceptual aspects of attempted monocular fixation of a bright point in a dark field are investigated. Eye movements during attempted fixation were studied: (a) when a bright point was fixed at the center of the dark visual field, (b) in the dark after extinction of the fixation point, and (c) when the image of a point was stopped with respect to the retina (stabilized point). Autokinetic movements of a bright point with and without stabilization of the retinal image were observed and compared with eye movements. Data reported on perceived direction of a point source as a function of retinal locus showed that the perceptual locus of a small light source is determined with great accuracy by its retinal locus. Test apparatus is described, and the experimental procedures used on the two subjects are detailed. Typical records of the eye movements are presented, the differences in response are assessed, and possible reasons for these variations are discussed. S.P.

N66-28828# Istituto Nazionale di Ottica, Florence (Italy).
SOME ASPECTS OF THE PERCEPTION OF LIGHT SIGNALS
Lucia Ronchi *In its* Probl. Related to Visual Performance of Pilots 20 Dec. 1965 p 34–68 refs (See N66-28826 16-05) CFSTI: HC $4.00/MF $0.75

Problems connected with light signal perception are examined, and data are reported on several experiments to determine the effects of various parameters in relation to signal recognition and discrimination. Foveal and extrafoveal vision tests were conducted in the areas of: (a) apparent shape and sharpness sensation under poor viewing conditions, (b) color recognition, (c) influence of eye adaptation on perception of red and blue signals, (d) influence of flickering signals and scattered light, (e) interference signals and field color, and (f) apparent fluctuation of signals of constant intensity and prolonged exposure. In the near periphery, red signals proved more suitable than blue signals. Observer responses indicated that the best signal was located at 520 nm where the sensitivity of the eye is relatively high, the photochromatic interval is small, and the sensitivity to luminance difference is relatively high. S.P.

N66-28829# Istituto Nazionale di Ottica, Florence (Italy).
ON THE VARIABILITY OF ELECTRORETINOGRAPHIC RESPONSE
Lucia Ronchi *In its* Probl. Related to Visual Performance of Pilots 20 Dec. 1965 p 69–86 refs (See N66-28826 16-05) CFSTI: HC $4.00/MF $0.75

The reliability of electroretinographic response (ERG), which is change in retinal potential occurring when the adaptational state of the retina is abruptly changed, is discussed on the basis of data recorded from human beings. The ERG reliability is dealt with in relation to changes in response due to inadequate stimulation, conditioning, adaptation, and discriminability. The level of light changes according to the seasonal cycle did not appreciably affect response size. A plot giving rate of increase of response vs. date of session supported the assumption that response could not be ascribed to change in the absolute value of recording resistance, nor to seasonal changes in the level of outdoor illumination. Tests supported the conclusion that scotopic ERG is much less reliable than psychophysical data. S.P.

N66-28830# Istituto Nazionale di Ottica, Florence (Italy).
VISUAL PERFORMANCE IN THE PRESENCE OF A STEP PATTERN OF ILLUMINATION
Adriana Fiorentini *In its* Probl. Related to Visual Performance of Pilots 20 Dec. 1965 p 87–104 refs (See N66-28826 16-05) CFSTI: HC $4.00/MF $0.75

Response of the eye to a step pattern of illumination is described in terms of the increment threshold for a small light patch added to the pattern at various distances from the illumination step. An experiment is conducted in which the increment threshold is measured by a narrow bar added to a step pattern at various locations on both sides of the edge. Test apparatus and procedures are outlined. Visual performance data indicate that a weak light signal, which can be clearly perceived when viewed against a uniform dark background and which can still be detected against a brighter background, would become invisible in the proximity of the edge between the dark and the bright area. S.P.

N66-28851# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.
PROBLEMS IN DEPTH PERCEPTION: A METHOD OF SIMULATING OBJECTS MOVING IN DEPTH
Walter C. Gogel and Henry W. Mertens Dec. 1965 12 p refs (AM-65-32)

Equations were developed for the simulation on a screen of the movement of an object or surface toward or away from an observer by the movement of a positive photographic transparency of the object or surface away or toward a point source. The general case was developed for simulating objects in which the distance of the observer from the screen was constant but not necessarily equal to the distance of the point source from the screen. Equations were developed relating the dimensions of the rigid transparency to those of the rigid simulated object. These equations, under a wide variety of conditions, permit the simulation of surfaces or objects moving in depth at any designated linear speed or acceleration with respect to the observer. Author

N66-28853# Library of Congress, Washington, D. C. Aerospace Technology Div.
SOVIET BIOTECHNOLOGY AND BIOASTRONAUTICS, DECEMBER 1964–JUNE 1965 Surveys of Soviet Scientific and Technical Literature.
Christopher H. Dodge 11 Feb. 1966 245 p refs Compilation of Abstracts
(ATD-66-14)

This compilation of abstracts is based on Soviet-Satellite open sources published 1962–1965. It reflects Soviet research in the fields of space biology, bioastronautics, and biotechnology published for the most part during the last quarter of 1964 and the first two quarters of 1965. Part I. Effects of altered gravity; Part II. Effects of vibration on physiological function; Part III. Biological effects of radiation; Part IV. Effects of hypothermia on mammals; Part V. Effects of altered gas environments; Part VI. Effects of combined stresses; Part VII. Biomedical effects of space flight; Part VIII. Life support systems; Part IX. Human engineering and man–machine factors; Part X. Monitoring, biotelemetry, and data processing; Part XI. Miscellaneous: Future flights, exobiology, ecophysiology. The first page of each part contains a list of the entries by number, title, and page number. Also included in the report are an author index and a subject index. There is no bibliography. Author

N66-28863# Royal Aircraft Establishment, Farnborough (England).

CONTRAST THRESHOLDS FOR AIR TO GROUND VISION

E. B. Davies Apr. 1965 50 p refs

(RAE-TR-65089) CFSTI: HC $2.00/MF $0.50

This paper compares a variety of laboratory detection data on the contrast thresholds of the eye for a variety of target parameters and experimental viewing conditions, such as, target size, background luminance, position of the target image on the retina, type of experimental technique (forced choice or free choice), etc. Data is chosen from this collection for comparison with some limited flight data on detecting ground objects from the air, and it is proposed that contrast thresholds applicable to these practical viewing conditions are obtained from the corresponding laboratory thresholds by increasing the laboratory thresholds by an amount which depends on the degree of difference between the laboratory and the practical viewing conditions. The data applies to zero, or at most small, search situations, and further work is necessary to determine its applicability to widespread search. Author

N66-28898# Flying Personnel Research Committee, London (England).

THE HUMAN FACTOR IN AIRCRAFT ACCIDENTS—INVESTIGATION OF BACKGROUND FACTORS OF PILOT ERROR ACCIDENTS

A. B. Goorney May 1965 37 p refs

(FPRC/MEMO-224) CFSTI: HC $2.00/MF $0.50

An investigation has been made to ascertain if certain factors were implicated in significant percentages of the pilot error accidents occurring during a two year period, with a view to more detailed studies of the causes shown to be most prominent. This study has been concentrated on flying experience and physiological and psychological aspects. Information obtained from the pilots involved in pilot error accidents during the period under investigation has been compared, where possible, with information obtained from controls drawn from pilots flying similar aircraft types who had not been involved in pilot error accidents during the same period. Author

N66-29173# Naval Training Device Center, Port Washington, N. Y.

AUGMENTING FEEDBACK AND TRANSFER OF TRAINING

Gene Micheli Mar. 1966 92 p refs

(NAVTRADEVCEN-1H-41; AD-631405) CFSTI: HC $9.60/MF $0.75

The major finding of the study which was not expected on the basis of previous studies of augmenting feedback was that increasing amounts of information in the augmenting feedback paired with primary feedback conditions that presented little information resulted in positive transfer effects. Specifically, it was found that subjects learned something about the difficult auditory tracking task which persisted following removal of highly informative visual augmenting feedback. This indicates the need to extend the range of task difficulty in augmenting feedback studies to account for tasks presenting very little informative feedback. Author (TAB)

N66-29178# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.

CAREFULNESS PEER RATINGS AS A PREDICTOR OF SUCCESS IN NAVAL AVIATION TRAINING Special Report 66-1

Floyd E. Peterson, Norman E. Lane, and Rosalie K. Ambler Feb. 1966 10 p refs

(AD-631752) CFSTI: HC $1.10/MF $0.50

Cadets were instructed to indicate whether each of the other members in their class was 'more careful' or 'less careful' than themselves. The Carefulness Ratings (CR) were correlated with scores on each of the primary selection tests and grades in Naval School, Pre-Flight, and the addition of CR to the validity of the Pensacola Student Prediction was investigated. CR had significant relationships to the majority of the primary selection tests and Pre-Flight grades currently employed as predictors. For this reason, despite a significant relationship of CR to the criterion of success/failure, its unique contribution was too small to be of practical value. Author (TAB)

N66-29206*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPLORATORY STUDY OF MAN'S SELF-LOCOMOTION CAPABILITIES WITH A SPACE SUIT IN LUNAR GRAVITY

Amos A. Spady, Jr. and William D. Krasnow Washington, NASA, Jul. 1966 17 p refs Film Supplement to this report is available on loan from Langley Research Center

(NASA-TN-D-2640) CFSTI: HC $1.00/MF $0.50 CSCL 06K

Tests were conducted to compare the effects of a pressurized space suit on man's self-locomotion capabilities at earth gravity and simulated lunar gravity. The suits used were tested at both 0 and 3.5 psi. A reduced gravity simulator was used to simulate lunar gravity. The test subject could walk, run, and perform both vertical and broad jumps under both gravity conditions; however, the tasks were easier and less tiring under lunar gravity. The subjects could jump vertical heights 6 to 7 times higher and perform standing broad jumps about 2 times further at lunar gravity (1/6 g) than at earth gravity (1 g). In general, pressurizing the suit to 3.5 psi reduced the performance by about 30 percent. The test subjects in the pressurized suits were able to perform at lunar gravity many tasks, such as climbing stairs, ladders, poles, and jumping onto a platform 6 feet off the floor, which could not be accomplished at 1 g. The simulator technique used adapted easily to the pressure suits. The comments of the test subjects and the results of the tests indicate that the reduced gravity simulator is an effective research and training tool, and should be very useful in the development of advanced types of space suits. Author

N66-29207*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARATIVE MEASUREMENTS OF MAN'S WALKING AND RUNNING GAITS IN EARTH AND SIMULATED LUNAR GRAVITY

Donald E. Hewes, Amos A. Spady, Jr., and Randall L. Harris Washington, NASA, Jun. 1966 39 p refs Film Supplement to this report is available on loan from Langley Research Center

(NASA-TN-D-3363) CFSTI: HC $2.00/MF $0.50 CSCL 06B

A study was conducted to evaluate the effect of lunar gravity on man's walking and running gait characteristics by comparing results of tests conducted in earth and simulated lunar gravity. The lunar tests were conducted by using a modified version of the reduced gravity simulator and the corresponding earth gravity tests were performed by using a portion of asphaltic concrete road of a length equal to that provided by the modified simulator. The test subjects wore lightweight flight coveralls and boots. The subjects walked and ran at various speeds up to their maximums for both gravity conditions. The data were obtained by using a high-speed motion-picture camera stationed 150 feet (46 m) normal to the center line of the track. The results of this study, which are useful primarily as base-line information, indicated that reduced gravity does have a definite effect on the angular movements of the hip, knee, and ankle joints and on the inclination of the body with walking and running. Maximum walking and running rates at simulated lunar gravity were found to be approximately 60 percent of those in earth gravity. A loping gait at about 10 feet per second (3 m/sec) in lunar gravity was, according to the test subjects' comments, the most natural method of self-locomotion. Author

N66-29281# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

ANTHROPOMETRY OF COMMON WORKING POSITIONS

Milton Alexander and Charles E. Clauser Dec. 1965 31 p refs (AMRL-TR-65-73; AD-632241) CFSTI: HC $2.00/MF $0.50

Twenty-six dimensions of the human body in various working positions (standing, bending, kneeling, squatting, supine, and sitting) were obtained by photography or by direct measurement. The purpose of the study was to provide the human engineer with anthropometric data of various missile worker's positions so that more adequate work stations can be designed. Each dimension is defined verbally and graphically; and the 5th, 25th, 50th, 75th, and 95th percentiles and other statistical data are presented. Author (TAB)

N66-29282 FMC Corp., Santa Clara, Calif. Central Engineering Labs.

INFILTRATION OF POROUS FOODS WITH HIGH CALORIC, NON-AQUEOUS, EDIBLE MATERIALS Final Report, 27 May 1964-27 May 1965

R. A. Lampi Natick, Mass., Army Natick Labs., Apr. 1966 119 p refs /its Tech. Rept.-66-28-FD

(Contract DA-19-129-AMC-84(N))

(FD-45; AD-632311) CFSTI: HC $4.00/MF $0.75

Methods together with suitable high caloric formulations were developed for filling the voids of representative baked items and freeze dried meats, fruits and vegetables. Panel tests for acceptability and relevant physical, chemical and microbiological observations are reported for infiltered products stored for 4 months at a maximum temperature of 38°C. Preparative experience was extrapolated into an engineering flow diagram for large scale production of infiltered foods. Author (TAB)

N66-29419*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A SURVEY OF LIFE-DETECTION EXPERIMENTS FOR MARS

Aug. 1963 77 p

(NASA-TM-X-54946) CFSTI: HC $3.00/MF $0.75 CSCL 06K

Results of a survey of life detection experiments for Mars are presented. The survey was conducted to determine the status and support requirements of a variety of experiments. Emphasis is given to determining which experiments may be available and suitable for the 1966 Mars Mariner mission. Experiments surveyed include the gas chromatograph, Gulliver, the J-band, the mass spectrometer, the multivator, optical rotation, the wolf trap, and several others. Of these, only the gas chromatograph, Gulliver, and multivator have a reasonable chance of meeting schedules imposed by the Mars Mariner mission. The most serious problems uncovered are common to nearly all experiments. No adequate sample collection, concentration, or preparation devices have been devised. Instrument prototype is being delayed by lack of a clear definition of the experiment-vehicle interface. The inability to control the landing site and uncertainties in the knowledge of the Martian atmosphere are factors greatly affecting the success probability of the life detection experiment. The uncertainties are so large that life detection experiments may not be suitable for a Mariner mission and may be more appropriate to a Voyager mission. R.N.A.

N66-29504# Royal Aircraft Establishment, Farnborough (England).

AIR TO GROUND APPLICATIONS OF VISUAL DETECTION LOBE THEORY

E. Heap London, Min. of Aviation, Jan. 1962 40 p refs Presented at AGARD Avionics Panel Meeting, Jul. 1962

(RAE-TR-ARM-2715) CFSTI: HC $2.00/MF $0.50

The theoretical equations for visual detection lobes, depending on the observed contrast of a ground object and its area, are applied to the air to ground role. Taking into account the meteorological range, atmospheric attenuation and the sky/ground brightness ratio, curves are produced which show the sectional area on the ground within which detection is possible. Optimum heights and look angles are determined such that the ground area is maximized for a given maximum slant range to the ground. Details of many varied detection lobes are also tabulated. Author

N66-29575*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

[FUNCTIONAL EXTENSION OF THE HUMAN HANDS] Progress Report, 1 Oct. 1965-31 Mar. 1966

24 Jun. 1966 10 p refs

(Grant NsG-107-61)

(NASA-CR-75911; SA-9991-5) CFSTI: HC $1.00/MF $0.50 CSCL 05H

Progress is reported in the development of remote sensors and manipulators. From a simulation study of supervisory control of a manipulator, it was determined that transmission delay does not make remote manipulation impossible. Additionally it was found that intermittent visual feedback, and the lack of rate formation in the display does not necessarily impair control performance; thus a low capacity feedback channel may be sufficient for manipulation tasks. The operation of the Supervisory Controlled Manipulator-1 is briefly discussed. The operator is able to assign a name for a certain positional configuration of the manipulator, and by calling the name assigned, he is able to return to that configuration. The techniques used for detecting and presenting

to the operator the sounds generated by the remote hand of a manipulator making contact with its environment are listed, and the conclusions drawn from these investigations are provided. Additionally it is reported that sufficient progress has been made to begin tests of an apparatus to provide an operator of a mechanical remote manipulator with an indication of the pressure applied at a number of discrete points on the remote fingers. H.S.W.

N66-29576# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
THE EFFECTS OF DURATION AND BACKGROUND NOISE LEVEL ON PERCEIVED NOISINESS
Karl S. Pearsons Apr. 1966 65 p refs
(Contract FA-65-WA-1180)
(FAA-ADS-78)

Judgment tests were conducted to investigate the effect of duration and background noise on the perceived noisiness of sounds. The tests were conducted in an anechoic chamber with 18 subjects. Aircraft noise recordings were employed in the background level test, and the results indicate that the presence of background noise reduces the judged noisiness of an aircraft flyover. The duration tests utilized stimuli with two different time patterns and various spectrum shapes over a range of durations from 4 to 64 seconds. Combining the results of these tests with those of a previous study provided duration information over the range from 1-1/2 to 64 seconds. These data suggest that the dependence of perceived noisiness on duration might well be a function with a continuously decreasing slope, varying from −6 to −2 PNdB per doubling of duration over the range of durations tested. For practical purposes, we have approximated the data by straight-line segments for various ranges of duration.
Author

N66-29591# Navy Electronics Lab., San Diego, Calif.
SPEECH INTERFERENCE ASPECTS OF NAVY NOISES Research and Development Report, Jan. 1961–Dec. 1964
J. C. Webster and R. G. Klumpp 2 Sep. 1965 146 p refs
(NEL-1314; AD-625262) CFSTI: HC $4.00/MF $1.00

Representative samples of ship, office, and shop noises were analyzed to determine simple methods for rating noise in shipboard spaces in relation to interference with speech communication. For simplicity in speech interference measurement, it is recommended that an average be taken of the octaves centered at 500, 1000, and 2000 cycles per second.
Author (TAB)

N66-29603# Ohio State Univ. Research Foundation, Columbus. Human Performance Center.
FURTHER INVESTIGATION OF THE EFFECTS OF REDUCED INPUT DATA FIDELITY UPON THE DETERMINATION OF POSTERIOR PROBABILITIES IN A SIMULATED THREAT-DIAGNOSIS SYSTEM Final Report, 15 Mar.–1 Aug. 1964
David A. Schum, Irwin L. Goldstein, and Jack F. Southard Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 23 p refs
(Contract AF 33(657)-10763)
(AMRL-TR-65-233; AD-631781) CFSTI: HC $1.00/MF $0.50

This is the fifth in a series of experiments on Bayesian diagnostic systems. In this experiment two procedures for obtaining a posteriori (P (H/D)) probability estimates were compared under conditions of low fidelity of input data and various levels of time-stress. In one procedure a computer aggregated the subjects' a priori (P (D/H)) estimates. In the alternate procedure the a posteriori probabilities were estimated by the subjects without computer aid. The results favor the computer-aided procedure and tend to support the use of automated Bayesian hypothesis-selection procedures in diagnostic systems.
Author (TAB)

N66-29647*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLIGHT CREW PROCEDURES AND TRAINING
Donald K. Slayton, Warren J. North, and C. H. Woodling *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 201–211 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Flight crew preparation activities outlined herein include initial academic training, engineering assignments, and mission training. Pilot procedures are discussed in conjunction with the simulation equipment required for development of crew procedures for the various phases of the Gemini mission. Crew activity summaries for the first five manned flights are presented, with a brief evaluation of the training effort.
Author

N66-29650*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MAN'S RESPONSE TO LONG-DURATION FLIGHT IN THE GEMINI SPACECRAFT
Charles A. Berry, D. O. Coons, A. D. Catterson, and G. Fred Kelly *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 235–261 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The biomedical data from the Gemini III through VII missions support the conclusion that man is able to function physiologically and psychologically in space and readapt to the earth's 1-g environment without any undue symptomatology. It also appears that man's response can be projected into the future to allow 30-day exposures in larger spacecraft.
Author

N66-29652*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ASTRONAUTS' REACTIONS TO FLIGHT
Virgil I. Grissom, James A. Mc Divitt, L. Gordon Cooper, Jr., Walter M. Schirra, and Frank Burman *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 271–276 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The Gemini spacecraft was designed to make use of man's ability to function in the space environment. The extravehicular activity carried out during the Gemini IV flight demonstrated that an astronaut could maneuver and work outside his spacecraft. Man's capabilities in space were further demonstrated with the successful rendezvous between Gemini VI-A and VII. Very few anomalies occurred during the first five manned Gemini flights, and most of the planned experiments were performed successfully. The flight crews have been well pleased with the Gemini spacecraft. Even though the cabin is small, the crews have been able to operate effectively and efficiently.
Author

N66-29658*# California Univ., San Diego. Visibility Lab.
EXPERIMENT S-8/D-13, VISUAL ACUITY AND ASTRONAUT VISIBILITY
Seibert Q. Duntley, Roswell W. Austin, John H. Taylor, and James L. Harris *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 329–348 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Preflight, inflight, and postflight test of the visual acuity of the members of the Gemini V and Gemini VII crews showed no statistically significant change in their visual capability. Observations of a prepared and monitored pattern of rectangles made at a ground site near Laredo, Tex., confirmed that the visual performance of the astronauts in space was within the statistical range of their respective preflight thresholds, and that laboratory visual acuity data can be combined with environmental optical data to predict correctly man's limiting visual capability to discriminate small objects on the surface of the earth in daytime. Author

N66-29664*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXPERIMENT M-3, INFLIGHT EXERCISE—WORK TOLERANCE

Lawrence F. Dietlein and Rita M. Rapp *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 393-396 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A day-to-day evaluation was conducted to determine the general physical condition of the Gemini VII flight crew with increasing time under space flight conditions. The study was based on the response of the cardiovascular system (pulse rate) to a calibrated workload. The exercise device consisted of a pair of rubber bungee cords attached to a nylon handle at one end and to a nylon foot strap at the other; 70 pounds of force was required to stretch the cords maximally to a length of 12 inches. Exercise periods of 30 seconds were scheduled twice daily. Additional isometric-isotonic exercises were performed approximately three times daily. Blood pressure measurements were taken before and after each exercise period. Results indicate that the cardiovascular system response to a calibrated workload is relatively constant for a given individual during the 14-day space flight, and that crew members are able to perform mild-to-moderate amounts of work. No decrement in the physical condition of the crew was noted. M.G.J.

N66-29697# California Univ., Los Angeles. Western Management Science Inst.

DECISION-MAKING

Jacob Marschak Dec. 1965 41 p refs *Its* Working Paper No. 93

(Contract Nonr-233(75))

(AD-632524) CFSTI: HC $2.00/MF $0.50

Descriptive decision theory is an extension of psychology or anthropology; prescriptive decision theory can be regarded as an extension of logic. Propositions of prescriptive theory can also be regarded as possible hypotheses of descriptive theory. Accordingly, an account of experiments that test such hypotheses is used to acquaint the reader with both the currently available empirical evidence and the main elements of current prescriptive literature. In addition, some alternative descriptive hypotheses are introduced, especially those of probabilistic nature; and the prescriptive materials are extended to include a brief discussion of sequential, informational, and exploratory strategies, and of the cost of decision. Author (TAB)

N66-29787# Human Engineering Labs., Aberdeen Proving Ground, Md.

MIDDLE-EAR MUSCLE EFFECTS ON LOW-INTENSITY SOUNDS

G. Richard Price Nov. 1965 22 p refs

(TM-16-65; AD-631360) CFSTI: HC $1.60/MF $0.50

Experiments in which loudness judgments were made for a tone in one ear while another tone was present in the opposite ear have questioned the role played by the middle-ear muscles. Loudness judgments probably involve both central and peripheral factors. In order to evaluate the peripheral factors, cochlear potentials were measured on 12 lightly anesthetized cats. There were changes in the cochlear potential to pure tones in one ear (ranging in frequency from 0.2 to 10 kilocycles) from middle-ear muscle activity elicited by contralateral two-second pure-tone bursts (ranging from 0.65 to 5 kilocycles) as the tones producing the cochlear potentials were varied in intensity. As the intensity of the measured tone was varied, the size of the effect (in dB) remained constant. Author (TAB)

N66-29803# George Washington Univ., Washington, D. C. Human Resources Research Office.

THE INFLUENCE OF PRACTICE FRAMES AND VERBAL ABILITY ON PROGRAMMED INSTRUCTION PERFORMANCE

William H. Melching and Frank B. Nelson Jan. 1966 28 p refs (Contract DA 44-188-ARO-2)

(HumRRO-TR-66-1; AD-628444) CFSTI: HC $2.60/MF $0.50

The effect of special practice frames upon programed instruction performance was examined using a program in counterinsurgency. The individuals who served as subjects represented two levels of verbal ability. Practice frames enabled subjects to proceed through the program at a faster rate per frame, make fewer program errors, and score higher on a recall type of achievement test. Subjects of higher verbal ability were able to proceed through the program at a faster rate, make fewer program errors, and exhibit higher scores on all measures of achievement. Author (TAB)

N66-29855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ASSAULT ON OUTER SPACE GOES ON

29 Apr. 1966 7 p Transl. into ENGLISH from Tekhn. i Vooruzheniye (USSR), no. 10, 1964 p 2-3

(FTD-TT-65-1903/1+4; AD-632313) CFSTI: HC $1.00/MF $0.50

Our Socialistic Fatherland has gone out to new boundaries in the development of astronautics. A powerful rocket carrier first took out into the endless distances of outer space the multiple-place spaceship, the Voskhod, aboard which there was laboring to accomplish their goal, carrying out a complicated and multilateral program of scientific investigations, a friendly group of astronauts, an engineer, a scientist, and a physician. These researches have uniquely important significance for further long flights of the crews of spaceships. Three in outer space on one ship—such a thing has never happened before, and from the moment when the Voskhod soared upward into the skies and went into its assigned orbit from all corners of our planet there flowed in greetings addressed to the Soviet people and its glorious sons, V. M. Komarov, K. P. Feoktistov, and B. B. Yegorov. The Soviet Union in opening up a new era in the history of mankind maintains the primacy, true to natural law, in the exploration and conquest of outer space, for this serious affair proves to be a component part of that gigantic creative work which the Soviet people is carrying on in accordance with the general line of the Communist Party in all branches of economy, science, and culture in the name of mankind for the benefit of mankind. TAB

N66-29869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEXTANT SIGHTING PERFORMANCE IN MEASURING THE ANGLE BETWEEN A STATIONARY SIMULATED STAR AND A STATIONARY BLINKING LIGHT
Robert J. Randle, Bedford A. Lampkin, and Emmett C. Lampkin Washington, NASA, Jul. 1966 27 p refs (NASA-TN-D-3506) CFSTI: HC $1.00/MF $0.50 CSCL 05H

In space flight, the target vehicle in a rendezvous maneuver might carry a high intensity blinking light as a marker and navigation aid for the chase vehicle. The present study was made to determine the ability of subjects to measure the angle between a simulated star and a blinking point of light of the same magnitude as the star. The subjects were eight male junior college students with normal visual acuity. Four were pretrained on the task and four were trained using as targets a simulated star and a steady light. The blinking light was given three levels of frequency and on-time, making possible nine experimental conditions. Two steady stars were used as a control. A Plath micrometer marine sextant was used to measure the angle by star superposition. There was no relative motion between the two targets. The sextant was mounted and did not need to be supported by the subject. The angle was measured with a digital encoder attached to the sextant vernier shaft. Performance decreased at the shorter on-times, in terms of larger variability in measured angle, and at the lower frequencies, in terms of longer sighting time.
Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-28527# Oak Ridge National Lab., Tenn.
THE PURIFICATION OF BERYLLIUM METAL BY A DISTILLATION PROCESS Summary Report
E. W. Hooper and N. J. Keen *In its* Conf. on the Phys. Met. of Beryllium [1963] p 1-5 (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

The process depends on two separation mechanisms: the fractional evaporation of Be from many of the less volatile impurities, and the fractional condensation on a heated surface at such a temperature that entrained impurity atoms of the more volatile elements are able to re-evaporate, leaving purer Be.
NSA

N66-28602# Brown Univ., Providence, R. I.
COMBINED LEED AND MASS SPECTROMETER MEASUREMENTS FOR ADSORPTION AND CATALYSIS
Inits Study of Surface Properties of Automatically-Clean Metals and Semicond. [1966] 14 p refs (See N66-28600 16-26) CFSTI: HC $4.60/MF $0.50

By means of a combined LEED and quadrupole mass spectrometer system backed with a titanium getter-ion and sorption pump vacuum system, analyses of residual and evolved gases in the system and the interaction between various gases and clean (100) nickel surface have been investigated. The main residual gas in the 10^{-10} Torr range was CO and the others were H_2, CO_2, and CH_4. In the case of electron-bombardment degassing of various parts of the system, the evolution of CO in all temperature ranges and of H_2 at low temperatures were observed. Exposure of an argon-ion-bombarded and annealed clean (100) nickel surface to nitrogen produced no new change in surface structure. The desorption spectrum for CO-covered nickel, produced by heating, consisted of at least three peaks. The first desorption peak was due to amorphously adsorbed CO; the second and third peaks were due to chemisorbed CO in different adsorption states. Amorphously adsorbed CO on oxygen covered (100) nickel did not react with chemisorbed oxygen which has a higher energy of adsorption. The resultant change in diffraction pattern by heating is mainly due to the removal of oxygen as CO produced by the reaction of impurity carbon with oxygen and not largely due to the diffusion of oxygen atoms into the bulk.
Author

N66-28605# Bureau of Mines, Minneapolis, Minn.
ACTIVITY OF MANGANESE IN LIQUID IRON-MANGANESE ALLOYS
C. W. Schultz, N. Riezance, and S. L. Payne 1966 19 p refs (BM-RI-6807)

The vapor pressure of manganese in equilibrium with a series of liquid iron-manganese alloys was determined by the carrier gas method over a broad range of alloy composition. From these data the activities of manganese in the iron-manganese system were calculated. The system appears to be ideal.
Author

N66-28634*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF THE GROWTH PARAMETERS INVOLVED IN SYNTHESIZING BORON CARBIDE FILAMENTS Final Report
A. Gatti, C. Mancuso, E. Feingold, and R. Jakas 1 Mar. 1966 53 p refs
(Contract NASw-1205)
(NASA-CR-75673; GE-214-269) CFSTI: HC $3.00/MF $0.50 CSCL 07B

Boron carbide (B_4C) whiskers exhibit attractive properties for utilization in composite materials. In terms of their high strength, low density, and high elastic modulus. These whiskers when utilized as reinforcements, offer great potential for high strength-to-weight or high stiffness-to-weight materials for future applications. B_4C whiskers were grown by the vaporization at high temperature of B_4C powder and the subsequent condensation of this vapor in the form of whiskers at a lower temperature. Strength measurements were made on typical whisker specimens at both room and elevated temperatures. A room temperature tensile strength of 2×10^6 psi was measured for one such whisker. Characterization studies of B_4C whiskers by X-ray techniques, light microscopy techniques, and electron microscopy techniques were made. Composites utilizing B_4C whiskers embedded in an aluminum matrix were fabricated by hot pressing and liquid infiltration methods and tested in tension at room and elevated temperatures.
Author

N66-28804# General Dynamics/Convair, San Diego, Calif.
HIGH TEMPERATURE SPECTRA OF THE 18-μ BAND OF CO_2
C. B. Ludwig, C. C. Ferriso, and L. Acton Nov. 1965 70 p refs
(Contract Nonr-3902(00); Proj. Defender)
(GD/C-DBE65-024; AD-477967)

Spectral emissivity measurements of the 15-μ band of CO_2 were made in the temperature range from 1000° to 2300°K. The hot gas was produced in a supersonic burner, which used gaseous carbon monoxide and oxygen as propellants. Many "hot" transitions were observed which were identified through their Q-branches even when the spectral resolution was not very high. The strength of the Q-branch (at 670 cm^{-1}) at a temperature of 2300°K was estimated, utilizing detailed line calculations for the fundamental transition and band model calculations for the higher transitions. A value for the integrated intensity of the ν_2-fundamental was also obtained at the highest temperature. The value of 240 ±15% is in agreement with other measurements at room temperature. In addition, spectral emissivities and the total integrated intensity of the (ν_3-ν_1) and (ν_3-$2\nu_2$) difference bands was obtained. Author

N66-28750# Los Alamos Scientific Lab., N. Mex.
THE SOLUBILITIES OF SELECTED ELEMENTS IN LIQUID PLUTONIUM. VII: NIOBIUM
D. F. Bowersox and J. A. Leary 11 Feb. 1966 13 p refs
(Contract W-7405-ENG-36)
(LA-3436) CFSTI: HC $1.00/MF $0.50

The solubility of Nb in liquid Pu was measured over the temperature range 700° to 1000°C. The solubility increased from 0.43% (by weight) Nb at 700°C to 1.48% Nb at 1000°C. The data fit the equation $\log N_{Nb} = 0.2771 - 2.183 \times 10^3\ T^{-1}$, where N_{Nb} is the solubility expressed as the mole faction and T is the temperature in degrees Kelvin. The solubility of Nb in liquid alloy, which initially was 49.3% (by weight) Pu, 40.8% Ce, and 9.9% Co, was measured from 500° to 900°C. The solubility increased from 0.053% (by weight) Nb at 500°C to 0.55% Nb at 900°C. The data fit the equation $\log X_{Nb} = -0.152 - 2.243 \times 10^3\ T^{-1}$, where X_{Nb} is the solubility expressed as the mole fraction and T is the temperature in degrees Kelvin. NSA

N66-28802* National Biomedical Research Foundation, Silver Spring, Md.
THERMODYNAMIC EQUILIBRIUM IN THE ORIGIN OF ORGANIC MATTER
Richard V. Eck, Ellis R. Lippincott, Margaret O. Dayhoff, and Y. T. Pratt (Maryland Univ.) *In its* Invest. of the Thermodyn. Mech. for the Production of Complex Compds. Essent. for the Origin of Life [1966] 22 p refs (See N66-28800 16-04)
CFSTI: HC $4.00/MF $1.00
(Grant NGR-21-002-059)

Theoretical and experimental support is presented for the hypothesis that organic compounds occurring in carbonaceous chondrites may have formed under equilibrium or near equilibrium conditions. The equilibrium distributions of organic compounds at temperatures between 300° and 1000°K and pressures of 10^{-6} to 50 atmospheres for the C-H-O system have been computed. At high temperatures and low pressures aromatic compounds may form even in the presence of excess hydrogen. Equilibrium concentrations of numerous compounds possible at 1000°K when N, S, and Cl are added to the system have also been determined. A limited equilibrium method is employed in which those few compounds which form with most difficulty are excluded from the computations. This approach is shown to be useful in the interpretation of certain experimental data. In preliminary experiments it has been found that gases, converted to the plasma state by high energy radio frequency discharge, yield product mixtures which are in qualitative agreement with those predicted. Author

N66-28835# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRESS IN SYNTHESIS OF NEW POLYMERS
M. M. Koton *In its* Plastics 5 Nov. 1965 p 1-22 refs (See N66-28834 16-18) CFSTI: HC $4.60/MF $0.50

The chemistry of high molecular compounds is discussed. Due to the discovery of new polymerization methods and the use of highly effective organometallic catalysts, it is stated that advances have been made in the polymerization of the simple aldehydes and ketones. The synthesis of polymers from dialdehydes, unsaturated aldehydes, and the synthesis of polymers with benzene rings and heterocyclic units in the main chain are also examined. Methods used by various investigators for synthesizing these compounds are described, and the formulas of the compounds obtained are provided. H.S.W.

N66-28838# Bureau of Mines, Minneapolis, Minn. Metallurgy Research Center.
ADSORPTION PHENOMENA AND THE REDUCTION OF IRON OXIDES. RELATION OF HEAT OF ADSORPTION TO HEAT OF ACTIVATION FOR THE REDUCTION OF WUSTITE AND MAGNETITE
Sanaa E. Khalafalla, C. W. Schultz, and T. N. Rushton 1965 26 p refs
(BM-RI-6699)

The Bureau of Mines investigated variations in the activation energy for the carbon monoxide reduction of magnetite and ferrous oxide with respect to the state of aggregation of the oxide material. Reduction phenomena can only be satisfactorily explained by including an adsorption step in the reduction process. Summation of the values of the exothermic heat of chemisorption and the variable apparent activation energy for reduction yields a nearly constant value of about 50 kcal for either ferrous oxide or magnetite regardless of whether they are aggregated in pelletized form or coarsely crystalline particles. Author

N66-28840# Bureau of Mines, Pittsburgh, Pa. Explosives Research Center.
DROP-WEIGHT TESTING OF EXPLOSIVE LIQUIDS
Charles M. Mason, Robert W. Van Dolah, and Milton L. Weiss 1966 23 p refs
(BM-RI-6799)

The Bureau of Mines evaluated equipment and procedures for drop-weight testing of explosive liquids as prescribed by Test 4, a widely used method. It was demonstrated that partial ignitions, originally designated as negative results, should be designated positives; it was also shown that wear or erosion of the sample cups and the type of mount used for the apparatus had important effects on the results. Relative sensitivity as measured by Test 4 was found to vary slightly with temperature. The Bureau also designed a fixed 2-kg weight and associated electromagnetic release, which subsequently was incorporated as standard in a revision of Test 4. The original concept that the test involves only adiabatic compression was found to be an oversimplification; an alternate mechanism for the initiation process is proposed in which due consideration is given to the effects of cavitation and microjets. Author

N66-28844# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
ELECTROLYTE LIFE IN WINNING TUNGSTEN FROM SCHEELITE
John M. Gomes, Kenji Uchida, and Don H. Baker, Jr. 1966 17 p refs
(BM-RI-6805)

In the repetitive electrowinning of tungsten from scheelite, the calcium impurity buildup in the molten electrolyte results in decreased metal purity, metal recovery, and current efficiency. Periodic addition of B_2O_3, which reacts with the lime liberated from the scheelite, more than tripled the life of the electrolyte in winning 99.9-percent-pure tungsten and also reduced the number of units of electrolyte required per unit of tungsten recovered from six to four. Author

N66-28879# Royal Aircraft Establishment, Farnborough (England).

SYNTHESIS AND PYROLYSIS OF POLYIMIDES HAVING NAPHTHALENE NUCLEI IN THE MAIN CHAIN

Shunichiro Nishizaki Feb. 1966 20 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 68, no. 9, 1965 p 1756–1761

(RAE-LIB-TRANS-1153) CFSTI: HC $1.00/MF $0.50

Polyimides having six-membered imide rings in the main chain were prepared by the condensation reaction, in dimethylacetamide, of naphthalene 1,4,5,8-tetracarboxylic acid dianhydride and various diamines. The polyimides were characterized by two infrared absorption bands, i.e., at $\nu_{c=0}$ 1712–1718 cm^{-1} (aromatics) and at $\nu_{c=0}$ 1705 and 1644 cm^{-1} (aliphatics). This indicated that the imides were produced by the intramolecular condensation of the amide acid. The pyrolysis was studied by the technique of thermogravimetry in air. It was found that N-aliphatic substituted polyimides decomposed rapidly at temperatures above 300°C while aromatic substituted types mainly began to decompose at above 400°C. Those containing diphenyl ethers proved to be thermally the most stable. The infrared spectra of pyrolyzed polyimides showed cleavage of the >NC bond in the aliphatic substituted types. Author

N66-28894# Joint Publications Research Service, Washington, D. C.

ELECTRIC CRACKING OF LIQUID ORGANIC RAW MATERIALS

N. S. Pechuro and A. N. Merkur'yev *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 68–81 refs (See N66-28888 16-15) CFSTI: $4.00

Decomposition of various liquid organic raw materials in electric discharges is examined in relation to the production of a gas rich in acetylene and other unsaturated compounds. Theoretical investigations of the mechanics of electric cracking of liquid organic materials, mainly individual hydrocarbons, are reviewed. It is noted that high voltage arc discharges, although costly, can be used very effectively for the decomposition of liquid organic products; and composition of gases produced in arcs of various powers is tabulated. Numerous other studies related to electric cracking are mentioned. M.W.R.

N66-28897# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Chemie.

APPLICATION OF NEUTRON ACTIVATION ANALYSIS FOR THE DETERMINATION OF IMPURITIES IN PURE COPPER [ANWENDUNG DER NEUTRONENAKTIVIERUNGSANALYSE ZUR BESTIMMUNG VON VERUNREINIGUNGEN IN REINKUPFER]

F. Lihl (Appl. Physics Inst., Vienna), P. Patek, and H. Sorantin Mar. 1966 32 p refs In GERMAN Submitted for Publication

(SGAE-CH-32/1966) CFSTI: HC $2.00/MF $0.50

Nondestructive radiochemical methods were used to determine impurities in various pure copper samples. Exposure of the specimens to neutron flux of differing intensities and durations, followed by γ-spectrum measurements of their activated impurity nuclides established traces of antimony, selenium, iron, silver, cobalt, zinc, nickel, and gold. Quantitative neutron analyses after chemical separation showed good agreement with spectral and X-ray fluorescence analytical methods and added tin and lead to the impurity list. In general, the neutron activation analysis of copper proved more sensitive and exact than the other methods.

Transl. by G.G.

N66-28917# Hokkaido Univ., Sapporo (Japan). Faculty of Engineering.

SYNTHESIS OF FIBROUS POTASSIUM TITANTE BY FLUX (K_2O–B_2O_3 SYSTEM) EVAPORATION METHOD

Hajime Saito and Nobuo Takusagawa *In its* Bull. of the Fac. of Eng., No. 37 Jun. 1965 p 19–25 refs (See N66-28916 16-34) CFSTI: HC $3.00/MF $0.50

Fibrous potassium titanate ($K_2Ti_6O_{13}$) was precipitated from solution by the evaporation of flux (K_2O–B_2O_3 system). Nonfibrous potassium titanate was prepared by the reaction of potassium carbonate with anatase mixed in a molar ratio of 1:6 and heated for one hour at 1450°C. After the nonfibrous potassium titanate was melted in the flux with a chemical composition of 3 K_2 0.5 B_2O_3 in a temperature ranging from 1050° to 1100°C and further with the weight ratio range of crystal to flux from 1:30 to 3:1, the flux was evaporated at the same temperature. As a result, long fibrous crystals were obtained at 1050°C for the shorter reaction times in the presence of a decrease of weight ratio of crystal to flux within a range of 1:5 to 1:1. Fibrous crystals with a maximal length of 1 cm and a mean length of 0.45 mm were precipitated after 2 hrs. at 1050°C. The evaporating rate of flux for a constant reaction time was minimal in the ratio of 1:1 and decreased with the increase of reaction time in spite of the fact that the rate was constant in the first reaction period. Author

N66-28922# Auburn Univ., Ala. Dept. of Chemistry.

A STUDY OF THE DECOMPOSITION MECHANISM OF AMMONIUM PERCHLORATE Quarterly Report, 1 Jan.–31 Mar. 1966

James E. Land [1966] 13 p refs

(Contract DA-01-021-AMC-12346(Z))

(QR-3; AD-631593) CFSTI: HC $1.00/MF $0.50

Data are recorded for the differential thermal analysis (DTA) of samples of mole parts of ammonium perchlorate mixed with mole parts of metal perchlorates in either 95/5 or 99/1 ratio. The runs were made to determine the influence of the additive on the DTA exo- and endotherms recorded for the decomposition of the ammonium perchlorate as it is heated at various rates over a given temperature range. The perchlorates used for doping the ammonium perchlorate were those of copper, lead, potassium, cadmium, zinc, manganese, silver, barium, magnesium, sodium, and iron. TAB

N66-28927# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

RAPID DETERMINATION OF MANGANESE AND ARSENIC CONTENT IN STEEL BY NEUTRON ACTIVATION ANALYSIS [DETERMINAZIONE RAPIDA DEL CONTENUTO DI MANGANESE E DI ARSENICO NEGLI ACCIAI COL METODO DI ATTIVAZIONE NEUTRONICA]

A. Moauro and C. Cesarano Oct. 1965 27 p refs In ITALIAN
(RT/CHI-(65)36)

Neutron activation analysis was used to determine Mn and As in stainless steel specimens. The determination of As after irradiation for two hours was obtained by dissolving the sample in a 37% HCl solution and distilling in HCl gas current. The activity of As^{76} in the distillate was measured by comparison with the activity of a standard. Mn was determined by 1 minute irradiation in the TEIGA reactor and gamma spectrometry without radiochemical separation by comparing Mn^{56} activity in the sample and a comparison standard.
Author (NSA)

N66-28956# Louisville Univ., Ky. Dept. of Chemistry.
DERIVATIVES OF SOME FIVE-MEMBERED HETEROCYCLES AS POSSIBLE PROTECTIVE AGENTS AGAINST IONIZING RADIATIONS Final Report, Jun. 1, 1962–Aug. 31, 1965
Kevin T. Potts Dec. 1965 122 p refs
(Contract AT(40-1)-3016)
(TID-22681) CFSTI: HC $4.00/MF $0.75

Methods for the synthesis of *s*-triazole derivatives, ring-fused *s*-triazole derivatives, meso-ionic compounds of the *s*-triazole series, and 1,3,4-oxadiazolium salts. The compounds were then evaluated for use in protection of mice against radiation. In general, maximum tolerated doses were given 15–20 min before exposure to 900 R whole-body x-radiation. All evaluations were made on a 30-day survival basis. Data on 45 compounds are tabulated.
NSA

N66-28962# Kansas State Univ., Manhattan. Engineering Experiment Station.
EFFECTS OF RADIATION QUALITY ON THE RADIOLYSIS OF WATER
Laurence Frederick Miller (M.S. Thesis) 1966 259 p refs /*ts* Special Rept.-66
(TID-22666) CFSTI: HC $6.00/MF $1.25

A theoretical investigation was made on problems associated with the prediction of chemical reaction rates and yields of radioinduced chemical reactions. All problems considered were related to the assessment of the effects of radiation quality (energy and type of radiation). Particular emphasis was given to the determination of the energy spectra of electrons resulting from the irradiation of water by 14.6 Mev neutrons and by Co^{60} gamma rays. Slowing-down spectra for charged particles produced in radiolysis were computed and used as a basis for models for the spur and track structure in irradiated water. Also involved in the establishment of the models were predictions of mean energy loss per spur and mean distance between spurs. These predictions, in turn, were based on empirical estimates of electron-scattering cross sections for low energy electrons and for small energy losses. Estimates of the yields of chemical reactions were based on approximate solutions of the partial differential equations describing simultaneous diffusion and chemical reaction along the tracks of charged particles. Yields were predicted for a simple chemical reaction and compared with experimental results previously determined. Author (NSA)

N66-28969# Iowa State Univ. of Science and Technology, Ames.
THE SEPARATION OF HIGH PURITY LUTETIUM AND YTTERBIUM BY ION EXCHANGE AT 90°C
J. E. Powell and H. Burkholder Jan. 1966 15 p refs
(Contract W-7405-ENG-82)
(IS-1305) CFSTI: HC $1.00/MF $0.50

An ion-exchange unit designed for continuous operation at 90°C and which includes a good method of preventing gas formation in heated columns, is described. The value of hot ion-exchange procedures for the production of lutetium and ytterbium oxides of very high purities is demonstrated.
Author (NSA)

N66-28972# Ceskoslovenska Akademie Ved, Rez.
DISCOVERY OF DAMAGE IN URANIUM FUEL ELEMENTS IN NONACTIVE TEST IN CO_2 [OBNARUZHENIE POVREZHDENIYA URANOVYKH TEPLOVYDELYAYUSHCHIKH ELEMENTOV PRI NEAKTIVNYKH ISPYTANIYAKH V POTOKE CO_2]
V. Zaiits, I. Vlchek, and M. Gudechek [1965] 20 p refs In RUSSIAN
(UJV-1369/65)

During the testing of fuel elements in a nonradioactive closed loop under nominal service conditions of pressure, temperature, flow rate, humidity, etc., the U contained in the element may become oxidized, entering the gas circuit in the form of U oxide aerosols. In order to find the damaged elements rapidly, a radiometric method was developed for detecting U-containing aerosols by passing the CO_2 stream through cellulose filters and analyzing the filter residue. A flow rate of 1 cm^3/sec per cm^2 of the filter was found to yield the best results. A scintillation detector with a photomultiplier was used for the radiometric determination of the deposit. The sensitivity of the method allowed a concentration of 2.77 mg/m^3 to be detected and concentrations of 27.7 mg/m^3 to be measured. The method is considered a reliable tool for recognizing the beginning of the deterioration of fuel elements subjected to loop testing. Further experiments are needed to adapt the method for the study of the kinetics of the deterioration reaction.
NSA

N66-28974# California Univ., Berkeley. Lawrence Radiation Lab.
IMPROVED TECHNIQUES FOR THE ANALYSIS OF NUCLEAR MAGNETIC RESONANCE SPECTROSCOPIC DATA: ANALYSIS OF FOUR-MEMBERED RING COMPOUNDS
T. R. Lusebrink (Ph.D. Thesis) Aug. 1965 200 p refs
(Contract W-7405-ENG-48)
(UCRL-16344) CFSTI: HC $5.00/MF $1.25

Two computer programs were written which substantially aid the analysis of complex NMR spectra. One program, DECOMP, allows the decomposition of super-imposed groups of peaks so that peak positions in an unresolved group can be determined nearly as accurately as resolved peaks. The second program, ASSIGN, calculates all possible sets of energy levels which are consistent with the observed frequencies and intensities of the completely resolved spectrum. This system of programs was utilized in the complete spectral analysis of two four-membered ring compounds; a class of compounds which have not previously been analyzed. The compounds are 3-chlorothietane and 3-thietanyl acetate, two highly mixed five-spin systems of the A_2B_2X type. Details of the analyses and listings of the computer programs are given. Extension of the method to six nuclei A_2B_4 systems, occurring in four membered rings, is also indicated.
NSA

N66-28982# California Univ., Berkeley. Lawrence Radiation Lab.
TWO ASPECTS OF ALLOY THERMOCHEMISTRY. A: VARIATION OF PROPERTIES WITH COMPOSITION IN ORDERED PHASES. B: SOLUTE INTERACTIONS IN DILUTE LIQUID ALLOYS

Raymond Leonard Orr (Ph.D. Thesis) 17 Sep. 1965 98 p refs
(Contract W-7405-ENG-48)
(UCRL-16320) CFSTI: HC $3.00/MF $0.75

A method is presented for calculating the compositional variation of the configurational thermodynamic properties of ordered intermetallic phases which exist over a range of composition by means of the substitutional defect mechanism. The treatment, which is an extension of the one of Wagner and Schottky, is applied to the simple quasichemical model analogous to that employed in the Bragg and Williams treatment of the variation of degree of order with temperature. The configurational thermodynamic properties are expressed as functions of the deviation from ideal stoichiometry and a composition dependent parameter which represents the atomic distribution. By minimizing the Gibbs energy with respect to the distribution parameter, an expression is obtained relating the equilibrium distribution with composition for given degrees of order at the stoichiometric composition. Solutions of this expression then permit the configurational properties to be evaluated as functions of composition for specified degrees of order at ideal stoichiometric. The method of treatment is derived in detail for phases having the CsCl-type superlattice structure, and the results of corresponding treatments for AuCu-type and $AuCu_3$-type superlattice phases are also given. Existing entropy of formation data for the AgMg, AuCd, and AuCu ordered phases are compared with values predicted by the treatments. Good correlations are obtained, leading to reasonable interpretations of the actual values in terms of the configurational and thermal contributions to the total entropies of formation. It is proposed that the methods developed could provide the basis for more elaborate or extensive treatments, either which incorporate other defect mechanisms or which employ higher-order approximations of the quasichemical model. Calorimetric measurements are reported for the heats of solution of gold and indium in a number of liquid tin-rich alloys at a temperature of 705°K. From the data, the partial molar enthalpies of gold are determined as a function of dilute solute concentrations in the binary Au-Sn system and in the ternary systems, Ag-Au-Sn, Au-Ni-Sn, and Au-In-Sn. Partial molar enthalpies of indium are determined for dilute solute concentrations in the In-Sn, Ag-In-Sn, and Au-In-Sn systems. The data are expressed in terms of the interaction parameter concept introduced by Wagner and more recently extended by Lupis and Elliott. Values are obtained for the gold-gold, silver-gold, nickel-gold, gold-indium, and silver-indium enthalpy interaction parameters in liquid tin. Values of enthalpy interaction parameters are also evaluated from existing data for the temperature variation of the Gibbs energy interaction parameter in four liquid ternary alloy systems. The results are interpreted in terms of solute atom distributions through comparisons with values of the enthalpy interaction parameters predicted by the random solution and Henry's law models for the dilute solution. Author (NSA)

N66-29011# Argonne National Lab., Ill.
ENGINEERING DEVELOPMENT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART 9: COMPUTER PROGRAMS FOR ALLOY-FUEL PROCESS CALCULATIONS
John T. Holmes and D. Ramaswami Dec. 1965 76 p
(Contract W-31-109-ENG-38)
(ANL-6992) CFSTI: HC $3.00/MF $0.75

In the processing of uranium alloy fuels, the metal is chlorinated in a bed of alumina particles fluidized by hydrogen chloride gas. The uranium is separated in this step since the alloying metal chlorides are relatively volatile and leave the fluid bed. In the second step, the non-volatile uranium chlorides are fluorinated with anhydrous hydrogen fluoride and fluorine to given uranium hexafluoride, which is volatile and thus separated from the alumina. During the process studies, three digital computer programs were developed to calculate material balances and to process experimental data. In the first program, material balances for the hydrochlorination step were calculated for a conceptual plant assuming values for alloy processing rates, equipment efficiencies, and input material flows. The calculated quantities are basic for economic evaluation studies of the hydrochlorination process. In the second program, pressure, temperature, and flowchart readings from a hydrochlorination-fluorination experiment were used as computer input data from which values of reaction rates, gas utilization, and concentrations were calculated. In the third program, uranium material balances were computed from analytical data, weight, and volumes of materials. Each computer program and an illustrative calculation are presented. The three programs are applicable to other processes, such as the decladding of zirconium or aluminum from low-enriched uranium dioxide fuels. Computer programs useful in the above applications for data correlation and for predicting properties of materials are outlined briefly.
Author (NSA)

N66-29012# Argonne National Lab., Ill.
LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART IX: THE FLUID-BED FLUORINATION OF PLUTONIUM-CONTAINING SIMULATED OXIDIC NUCLEAR FUEL IN A 1-1/2-INCH-DIAMETER REACTOR
R. L. Jarry, A. V. Hariharan, J. Fischer, M. J. Steindler, J. J. Stockbar et al Dec. 1965 53 p refs
(Contract W-31-109-ENG-38)
(ANL-7077) CFSTI: HC $2.00/MF $0.50

Fluid-bed fluorination of simulated oxidic nuclear fuels containing plutonium was investigated. Work was performed to determine the best reaction conditions for the conversion of the uranium and plutonium content of the simulated nuclear fuel to their respective hexafluorides. The experimental work involved the fluid-bed fluorination of mixtures containing U_3O_8, PuO_2, nonradioactive fission-product (F.P.) element oxides, and alumina. The uranium-to-plutonium weight ratio in the mixtures was 1000:4, and the uranium-to-alumina weight ratio was 1:2. The F. P. mixture contained several oxides. The results showed that more than 99% of the uranium could be removed from the alumina bed at reaction temperatures of 450-500°C. However, a temperature of 550°C and a reaction time of 10 hr were needed to satisfactorily remove plutonium from the alumina bed. A 20-hr fluorination, employing periods of 5 hr at 450°C, 5 hr at 500°C, and 10 hr at 550°C, resulted in the removal of 96-98% of the plutonium from the alumina. The recovery of plutonium can be further increased to >99% by reuse of the alumina bed for several additions and fluorinations of the U_3O_8-PuO_2-F.P. mixture. Plutonium retention on the alumina was affected by the flow rate of the fluorinating gas and by the quantity of fission products or plutonium in the solid reaction mixture. NSA

N66-29019# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
LIQUID MEDIA FOR DENSITY MEASUREMENTS OF BERYLLIUM, PLUTONIUM, AND URANIUM
H. N. Elsheimer 25 Feb. 1966 30 p refs
(Contract AT(29-1)-1106)
(RFP-691) CFSTI: HC $2.00/MF $0.50

An extensive literature survey was conducted to ascertain the optimum liquid media for determining the densities of beryllium, uranium, and plutonium. In conjunction with the literature survey, a limited amount of experimental work was done with Freon 113, fluorocarbon, a potentially useful immersion liquid for all three types of metals, especially beryllium. Successful application has been made of this particular compound for not only beryllium, but also plutonium.
Author (NSA)

N66-29036# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CHEMICAL COMPOUNDS FORMED BY THE RARE GASES [LES COMPOSES CHIMIQUES DES GAZ RARES]
Gerard Kuhn Jan. 1966 38 p refs In FRENCH
(CEA-BIB-58)

A review is presented on the properties of rare gas atoms and the preparation and properties of all known compounds up to January 1, 1965. Different theories attempting to explain the existence of these compounds were examined and some applications are described. (139 references.)
Author (NSA)

N66-29047# Purdue Research Foundation, Lafayette, Ind.
POLAROGRAPHY IN NON-AQUEOUS SOLVENTS Final Report, 1951–1966
Thomas De Vries Mar. 1966 40 p refs
(Contract AT(11-1)-163)
(TID-22725) CFSTI: HC $2.00/MF $0.50

Polarographic techniques were used to study the reduction of organic compounds in organic solvents and inorganic cations in fused salts. The study was directed to determine which variables influenced polarographic data such as wave height, half-wave potentials, and heterogeneous reaction rate constants. The results are presented in two sections: the use of organic compounds as solvents and use of fused salts.
NSA

N66-29057# Instituto de Energia Atomica, Sao Paulo (Brazil).
DEVELOPMENT OF RADIOCHEMISTRY ACTIVITIES IN NEW RESEARCH REACTOR CENTERS
Fausto W. Lima Aug. 1965 28 p refs Presented at the Meeting on the Utilization of Res. Reactors, Sao Paulo, Brazil, 4–8 Nov. 1963
(IEA-100; CONF-631104-8)

The types of research in radiochemistry and chemistry that are liable to be found, and have to be solved, in new institutions centralizing their activities around a research reactor of the swimming-pool type are described. The three main types of research to be developed include: tracer studies, production and processing of radioisotopes, and radiochemical and classical chemical analysis.
NSA

N66-29063# Ceskoslovenska Akademie Ved, Rez.
A STUDY OF RADIOLYSIS OF ORGANIC BINARY MIXTURES FROM THE POINT OF VIEW OF RADIATION SYNTHESIS
B. Chutny, P. Kourim, J. Kucera, J. Urban, J. Vagner et al 1966 23 p refs
(UJV-1468)

The radiolysis of binary mixtures of olefinic compounds with carbon tetrachloride or isopropyl alcohol was studied. From the variation of yields of reaction products with the initial composition of the mixtures the way in which they are formed was established and optimum conditions leading to the addition products were found.
Author (NSA)

N66-29076*# General Precision, Inc., Little Falls, N. J. Research Center.
HIGH TEMPERATURE STABLE CARBORANE ADHESIVES First Quarterly Progress Report, 21 Dec. 1965–20 Mar. 1966
Robert Barnes 15 Apr. 1966 31 p refs
(Contract NAS9-6527)
(NASA-CR-65399) CFSTI: HC $2.00/MF $0.50 CSCL 07C

Intermediates were synthesized and accumulated for the preparation of several epoxyalkylcarboranes and diepoxyalkylcarboranes. Emphasis was placed on the conversion of decaborane to carborane in a stepwise fashion. The following materials were synthesized using this step method: 6,9-bis(acetonitrilo)decaborane; 1,2-bis(acetoxymethyl)carborane; and 1,2-bis(hydroxymethyl)carborane. A sample of carborane was converted to the dialkenyl derivative, 1,2-bis(3-butenyl) carborane. In addition, a 50 gm sample of 1-(3-butenyl) carborane was purified, and its infrared spectrum was recorded and used for the characterization of the above mentioned dibutenylcarborane.
D.T.

N66-29095# Ceskoslovenska Akademie Ved, Rez.
STUDY OF SOME CONCENTRATION-DEPENDENT DISTRIBUTION METHODS FOR THE DETERMINATION OF ZIRCONIUM IN SUBMICROGRAM AMOUNTS
M. Kyrs, J. Rais, P. Pistek, and P. Selucky 1965 19 p refs
(UJV-1434/65)

Several heterogeneous systems were used to test the possibility of determining Zr in concentrations of 5×10^{-9}g and higher, and to allow a decision on the experimental arrangement most suitable for the needed sensitivity of the determination. In these systems Zr underwent distribution with no masking reagent present and another distribution was accomplished in the presence of EDTA and oxalic acid in concentrations of 2.5×10^{-7}M. From the results, it was concluded that the method of concentration-dependent distribution, a method based on the radial distribution on a paper disc, into which about 0.06 ml of the solution are transferred, appears to be best suited for a practical application.
NSA

N66-29104# Carnegie Inst. of Tech., Pittsburgh, Pa.
RADIATION CHEMISTRY Final Report, 1 Apr.–31 Aug. 1965
Gilbert J. Mains 20 Feb. 1966 26 p refs
(Contract AT(30-1)-2007)
(NYO-2007-9) CFSTI: HC $2.00/MF $0.50

Mercury sensitized photolysis techniques were applied to the synthesis of volatile hydride derivatives of carbon, silicon, and germanium. Methylsilane, germylsilane, and germyl methyl ether were prepared by the mercury photosensitized decomposition of methyl iodide–silane, germane-silane, and methanol–germane mixtures respectively. Some physical properties of the new compound germyl methyl ether are described. The radiolysis of tetramethylsilane (TMS) in the liquid phase was investigated in order to provide information relative to the effect of phase on primary product yields and reaction mechanisms. The results showed significant differences in product distribution as compared with the gas phase data. The liquid phase products are tentatively explained by a free radical mechanism, while the

difference in product distribution observed for the two phases irradiated was interpreted in terms of cage effects in the liquid. Data obtained from scavenger studies, and information provided by isotopic distributions observed in the products from irradiation of an equimolar mixture of TMS and TMS-d_{12} suggest that the contribution of molecular elimination reactors to the products of liquid phase radiolysis cannot be ignored. A mercury photosensitization study was undertaken to determine the relative efficiencies of SiH_4 and C_2H_4 as H atom scavengers. The atoms are generated from deuterium so that the reaction competition can be investigated by examining the distribution of deuterated products. Very preliminary studies indicate that the reaction scheme is somewhat more complicated than anticipated, and that it may be necessary to synthesize some partially deuterated hydrocarbons for use as standards in order to accurately estimate the reaction products. Author (NSA)

N66-29150# Northeastern Univ., Boston, Mass.
STUDIES ON FOAM FRACTIONATION AND APPLICATION TO LIPOID MATERIALS Final Report, Jul. 1964–30 Sep. 1965
Barry L. Karger Natick, Mass., Army Natick Labs., Apr. 1966 58 p refs
(Contract DA-19-129-AMC-302(N))
(TR-66-25-FD; FD-43; AD-631995) CFSTI: HC $3.00/MF $0.50

A simplified apparatus has been developed for the recovery and concentration of ionic species by foam fractionation. The process involves total reflux by thermal breakage of foam at the top of the column. Mechanical breakage can also be used when heat sensitive materials are used. The system has been applied to several dyes initially and then to the successful recovery of phospholipids and trace concentrations of salts of fatty acids. Solvent sublation has also been investigated as a selective separation technique. Exploratory studies indicate that the extraction process is kinetically controlled and that time might therefore be an effective separation parameter. Author (TAB)

N66-29155# Pennsylvania State Univ., University Park. Materials Research Lab.
CRYSTAL CHEMISTRY STUDIES Third Quarterly Report, 14 Nov. 1965–13 Feb. 1966
Rustum Roy, G. J. Mc Carthy, O. Muller, and W. B. White Ft. Monmouth, N. J., Army Electronics Command, Apr. 1966 11 p
(Contract DA-28-043-AMC-01304(E))
(ECOM-01304-3; AD-631987) CFSTI: HC $1.00/MF $0.50

Work was focused on the characterization of the rare-earth–rhenium compounds and a new compound of samarium. Precise unit cell data are reported for Yb_2ReO_5, Er_2ReO_5, and Dy_2ReO_5. Nd_2ReO_5 is polymorphic and cell data for both forms are reported. The results of a large sequence of experiments are reported in which compound formation was sought between ReO_2 and MgO, CdO, Sb_2O_3, Al_2O_3, Cr_2O_3, and Fe_2O_3. The samarium compound tentatively identified as Sm_3O_4 is now thought to be a silicate 2 Sm_2O_3·SiO_2. Author (TAB)

N66-29192# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CRYSTAL STRUCTURE OF THE NEW SILICON CARBIDE POLYMORPH 69R
Chang-Ling Kuo 15 Mar. 1966 7 p refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 5, 1964 p 459-461
(FTD-TT-65-692/1+2+3+4; AD-631765) CFSTI: HC $1.00/MF $0.50

The 69R polymorph is one of the 32 silicon carbide polymorphs recently discovered by us. The space group is R3m and the unit cell is hexagonal with cell dimensions: a=3.0808 A; c=173.85 A; z=69. This new plymorph was discovered in crystals prepared by three laboratory sublimation methods and in two industrial silicon carbide crystal plates. They all pair with the fundamental type 6H. The five ways of pairing are: 6H+69R+87R, 6H+69R+..., 6H+21R+39R+69R, 6H+69R and 6H+15R+15R+69R. The crystals are thin, almost hexagonal plates, 3×3 microns in size and about 0.2–1.0 micron thick. For 69R there are more than a hundred thousand ways of close stacking. Based on the known SiC structural analyses and considering the characteristics of the SiC crystal structure, it is possible to form the zig-zag sequence from two or three of the pairs of numbers. These two or three pairs come from the eight pairs 22, 21, 23, 32, 33, 34, 43 and 44. Between twenty and a hundred different zigzag sequences can be formed from two numerical pairs, and several hundred kinds from three pairs. The crystal structure of polymorph 69R can be represented by the zigzag sequence (33333332)3. TAB

N66-29194# TRW Systems Group, Redondo Beach, Calif.
RESEARCH AND APPLICATIONS PROGRAM FOR A SOLID CHEMILUMINESCENT REACTANT Final Report, 28 Jun. 1965–31 Mar. 1966
E. D. Guth and J. L. Dyer [1966] 90 p refs
(Contract DA-04-495-AMC-796(A))
(TRW-4489-6007-R0000; AD-631458) CFSTI: HC $3.00/MF $0.75

STELLER is a solid material which, when reacted with a suitable oxidizer, emits chemiluminescent light. The current oxidizer is a solution of ceric ammonium sulfate. Program activities were divided into two experimental tasks. The first task consisted of the production of the STELLER required for the program, determination of the physical and chemical properties of STELLER, sensitivity testing, and an aging and materials compatibility evaluation. The second task consisted of experimental activites which established the parameters which control the chemiluminescent performance (intensity and duration) and optimized the composition of selected formulations. TAB

N66-29195# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
ELECTRO-OXIDATION OF SATURATED HYDROCARBONS ON PLATINIZED PLATINUM IN PHOSPHORIC ACID Interim Technical Progress Report, 7 Sep. 1965–6 Apr. 1966
E. Gileadi and G. Stoner 22 Apr. 1966 32 p refs
(Contract DA-44-009-AMC-469(T))
(AD-632319) CFSTI: HC $2.00/MF $0.50

The anodic oxidation of propane in phosphoric acid has been studied on a platinum black electrocatalyst in the temperature range 100°–150°C. A rotating cylinder electrode was used for obtaining reaction orders with respect to propane and will be used in studies of other saturated hydrocarbons, now in progress. The purpose is to extend the present mechanistic study of hydrocarbon oxidation to various isomers of saturated hydrocarbon containing six carbon atoms. This will yield important parameters pertinent to 'fuel cell performance' in terms of structural and molecular weight effects. TAB

N66-29202# Indiana Univ., Bloomington. Dept. of Chemistry.
SPECTROMETRIC STUDIES OF FAST REACTIONS Final Report
Edward J. Bair [1966] 11 p refs
(Contract AF 49(638)-1257)
(AFOSR-66-0596; AD-631787) CFSTI: HC $1.10/MF $0.50

The project was undertaken in order to develop and demonstrate new spectroscopic procedures for studying both the detailed path and the elementary processes of photolytically initiated explosions similar in some respects to combustion reactions which also proceed by free radical and energy chain processes. Following the development of a highly reproducible reaction system, different spectroscopic features of the same system are studied by repeating the reaction. Special precautions to ensure that the system is homogeneous tend to isolate the chemical dynamics part of the combustion problem from the fluid dynamics part. With long absorption path and low dample pressure the time resolution of the measurements is reasonably comparable with the time between intermolecular collisions. A fast, high resolution spectrometer specifically designed for this work resolves transient energy features such as the rotational fine structure of free radical absorption with a time resolution of about a microsecond. In the photolytic explosion of ozone the time dependence of the ozone concentration, ozone vibrational energy, vibrational energy of the oxygen product in levels up to 23 and the rotational-kinetic temperatures were correlated. In the photolytic explosion of hydrazine the relative time dependence of NH_2 radicals, NH radicals, hydrazine and a new transient spectrum not yet fully identified were compared. Author (TAB)

N66-29238# Spinedi (Paolo), Rome (Italy).
RESEARCH INTO THE CHEMICAL BEHAVIOR OF SURFACES OF SINGLE-CRYSTALS, BI-CRYSTALS, AND TRI-CRYSTALS UNDER DIFFERENT EXPERIMENTAL CONDITIONS Second Quarterly Technical Status Report, 1 Oct.–31 Dec. 1965
Paolo Spinedi Dec. 1965 8 p
(Contract DA-91-591-EUC-3593)
(AD-632370) CFSTI: HC $1.00/MF $0.50

Under preceding contracts some studies on controlled oxidation of single-crystal surfaces had been carried out, the metals there considered being zinc, cadmium, tin, bismuth and germanium. Now, a first group of specimens of the said metals previously used in oxidation tests have been observed during their exposure to a hydrogen ion bombardment. In addition to a careful examination of the state of the surface after such a long aging at room temperature, the aim of such experiments was substantially to ascertain whether the hydrogen ion bombardment could give some data about the reducing mechanism of any surface distribution of oxide nuclei. TAB

N66-29242# General Electric Co., Philadelphia, Pa.
RESEARCH IN THE USE OF LIGHT AMPLIFICATION BY STIMULATED EMISSION IN ENERGY TRANSFER Final Report, 15 Nov. 1964–15 Nov. 1965
Richard N. Griffin and B. Linder Wright-Patterson AFB, Ohio, ARL, Jan. 1966 48 p refs
(Contract AF 33(615)-2230)
(ARL-66-0002; AD-631973) CFSTI: HC $2.00/MF $0.50

The kinetics of phosphorescence decay of ten organic compounds were measured. Some decay rates were found to be exponential within 1%, while others were either non-exponential at all stages or were resolved into a sum of exponential. The existence of multiple metastable triplet levels is proposed as the explanation of non-exponential decay. The usefulness of triplet–triplet absorption measurements in conjunction with phosphorescence decay measurements was demonstrated. It was shown that energy transfer from the donor is the rate controlling step in the phosphorescence decay of biphenyl in the carbazole-biphenyl system. An extremely efficient transfer of energy was observed from the triplet state of pyrazine to the singlet of a europium chelate, resulting in prolonged europium fluorescence. The observed kinetics can be explained in terms of a difference in the transfer efficiency of two forms of the pyrazone triplet. Author (TAB)

N66-29281# Naval Research Lab., Washington, D. C.
FACTORS AFFECTING THE SURFACE-CHEMICAL DISPLACEMENT OF BULK WATER FROM SOLID SURFACES Interim Report
H. R. Baker, C. R. Singleterry, and W. A. Zisman 24 Feb. 1966 14 p refs
(NRL-6368; AD-632084) CFSTI: HC $1.00/MF $0.50

Bulk water films can be displaced from a solid surface by a spreading organic liquid which creates and maintains a surface tension gradient in the air/liquid interface. Such a gradient can be maintained if the spreading agent escapes from the air/water interface by solution or evaporation after a few centimeters of travel away from the point of application. The resulting movement of the surface film sweeps along the water beneath by viscous entrainment (Marangoni effect). Displacement is effective and lasting only when the displacing agent (or a surface-active material dissolved in it) is strongly adsorbed to form an insoluble hydrophobic film on the solid surface. Effective water-displacing agents at 20°C should have the following properties: a spreading pressure above 25 dyn/cm on water, a boiling point above 90°C, and a solubility in water of between 2 and 25 percent by weight. The equilibrium spreading pressures for members of a given class of polar organic compounds decrease with rising boiling point. (These principles are well exemplified by a solution in normal butanol of 3 percent of basic barium dinonylnaphthalene sulfonate.) Such water-displacing agents have been found suitable in numerous applications. Author (TAB)

N66-29295*# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
SUBSTITUENT EFFECTS IN UNIMOLECULAR ION DECOMPOSITIONS. III: ELUCIDATION OF COMPETING ALTERNATIVE PATHWAYS FOR THE FORMATION OF A PARTICULAR ION
Maurice M. Bursey and F. W. Mc Lafferty [1966] 26 p refs Presented in part at the 150th Natl. Meeting, Am. Chem. Soc., Atlantic City, Sep. 1965 Submitted for Publication
(Grant NGR-15-005-021)
(NASA-CR-75820) CFSTI: HC $2.00/MF $0.50 CSCL 07C

Substituent effects may be used to indicate the existence of two pathways for the formation of an ion in mass spectra. For example the $C_6H_5^+$ ion in the mass spectra of substituted benzophenones is indicated to be formed by two pathways: (1) directly from the molecular ion, and (2) through the intermediacy of the benzoyl ion. This mechanism is confirmed by elimination of the first process at low voltages. Similar data are found for the $C_3H_7^+$ ion in the spectra of substituded butyrophenones. Further use of the low-voltage technique is demonstrated in the determination of the origin of the $C_2H_3O^+$ ion in m- and p-t-butylacetophenone. Author

N66-29335*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INFRARED REFLECTIVITY OF SOME COMMON MINERALS

W. A. Hovis, Jr. [1965] 24 p refs Submitted for Publication (NASA-TM-X-56482) CFSTI: HC $1.00/MF $0.50 CSCL 07B

Infrared reflectivities of minerals of the carbonate, sulfate, nitrate and silicate families exhibit spectral features that can be detected in reflection from surface minerals. These features could be used to identify such minerals from infrared reflection spectra of the moon and some planets and could also be a source of confusion in interpretation of atmospheric spectra. Author

N66-29362*# National Aeronautics and Space Administration, Washington, D. C.

CHARGE-TRANSFER STATES IN ORGANIC SYSTEMS [SOSTOYANIYA S PERENOSOM ZARAYADA V ORGANICHESKIKH SISTEMAKH]

V. A. Benderskiy and L. A. Blyumenfel'd Apr. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 144, no. 4, 1962 p 813–816

(NASA-TT-F-8848) CFSTI: HC $1.00/MF $0.50 CSCL 07D

This paper advances a hypothesis that the local states responsible for the electrical and magnetic properties of three types of organic systems are states involving charge transfer either between molecules or between discrete segments of conjugation in the molecule. The hypothesis provides a basis for an explanation of the formation of carriers in terms of a dissociation of complexes with charge transfer. R.N.A.

N66-29378*# Stanford Univ., Calif. Instrumentation Research Lab.

3-METHOXY-DIHYDROFLUORAN-6-OL-6-PHOSPHATE: A FLUOROGENIC SUBSTRATE FOR THE DETECTION OF ENZYMATIC ACTIVITIES

Elie A. Shneour 11 May 1965 21 p refs

(Grant NsG-81-60)

(NASA-CR-64015; IRL-1015) CFSTI: HC $1.00/MF $0.50 CSCL 06A

The synthesis, purification, and use of 3-methoxy-dihydrofluoran-6-ol phosphate (MHFP) for the detection of enzymatic activities in soils by the appearance of fluorescence after biological oxidation of MHFP, are described and discussed. Factors governing the rate of hydrolysis (influence of light e.g.) are considered. The preparation of MHFP from the monomethyl ether of fluorescein and the preparation of fluorescein diphosphate (HFDP) which has similar fluorescent properties are given. Results obtained for the spontaneous hydrolysis of both phosphates (in 0.05 M pH 7.5 tris-hydroxy methyl amino methane/maleic acid buffer at 22° C) indicate that MHFP hydrolyzed about four times faster than HFDP. The rate data were determined by the appearance of fluorescence appearing after biological oxidation. An inorganic phosphate was used as the control. Experimental hydrolysis of MHFP in acidic and alkaline solutions, with alkaline phosphatases, and with soil samples are discussed; and data curves are presented. L.S.

N66-29385# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

VARIATIONAL THEORY OF REACTION RATES

James C. Keck Jan. 1966 55 p refs

(Contract Nonr-1841(93))

(Publ.-66-1; AD-629937) CFSTI: HC $6.60/MF $0.75

The variational theory of reaction rates is reviewed and used to derive a general expression for the reaction rate constant corresponding to the flow of representative points in phase space through any trial surface separating reactants and products. It is shown that unimolecular decay theory, absolute reaction rate theory, available energy theory, and statistical reaction rate theory are all special cases of the variational theory corresponding to different choices of the trial surface. Applications of the theory to three-body recombination and dissociation are considered in detail and expressions for the available energy, three-body collision, Wigner and barrier-rate constants derived and compared. Methods of correcting the theory using Monte Carlo trajectory calculations are discussed. Author (TAB)

N66-29386*# National Aeronautics and Space Administration, Washington, D. C.

LAWS GOVERNING THE OCCURRENCE OF RARE EARTH ELEMENTS [ZAKONOMERNOSTI RASPREDELENIYA REDKOZEMEL'NYKH ELEMENTOV V ZEMNOY KORE]

Yu. A. Balashov Jul. 1963 23 p refs Transl. into ENGLISH from Geokhimiya (Moscow), no. 2, 1963 p 99–114

(NASA-TT-F-8467) CFSTI: HC $1.00/MF $0.50 CSCL 08D

Correlation ratios of rare earth elements were established and a systematic study was made of rare earth elements in rocks of the earth's crust. Maximum variations in rare earth elements were observed in alkaline rocks and granites. All rocks of the earth's crust (including sedimentary and metamorphic) are distinguished by a higher content of rare earth elements (with relative concentrations of the cerium group) as compared with the silicate phase of chondrites assumed to be analogous to the matter in the mantle. The mantle is probably connected with dissemination chiefly of the yttrium group of rare earth elements in abyssal differentiates of the mantle (dunites) due to isomorphic dispersion of rare earth elements in Fe- and Mg silicates. Author

N66-29408*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

USE OF CARBON DIOXIDE TO CALIBRATE INSTRUMENTS FOR DETERMINATION OF CARBON BELOW 50 PARTS PER MILLION IN METALS

Emery J. Merkle and Judson W. Graab [1965] 9 p refs Submitted for Publication

(NASA-TM-X-56717) CFSTI: HC $1.00/MF $0.50 CSCL 07B

In the determination of carbon below 50 parts per million, organic compounds have been used for calibration in the absence of suitable metallic standards. The addition of gaseous carbon dioxide (CO_2) as a calibration technique is proposed. A comparison of standardizations with an organic compound and with CO_2 additions is presented. A significant improvement in the precision of a calibration curve by using CO_2 is demonstrated. Author

N66-29444*# National Aeronautics and Space Administration, Washington, D. C.

THE METHOD OF INVESTIGATING METEORITES AND TEKTITES WITH THE AID OF INFRARED SPECTROMETRY [METOD ISSLEDOVANIYA METEORITOV I TEKTITOV S POMOSHCH'YU INFRAKRASNOY SPEKTROMETRII]

A. A. Kadushin and G. G. Vorobyev Nov. 1963 10 p refs Transl. into ENGLISH from Meteoritika (USSR), v. 22, 1962 p 104–109

(NASA-TT-F-8711) CFSTI: HC $1.00/MF $0.50 CSCL 08D

The application of infrared spectrometry in the investigation of meteorites and tektites was discussed. The tektites, being amorphous bodies, make the application of X-ray and differential thermal methods of analysis impossible; therefore, the infrared method is the only remaining practical structural method of investigation. The operating principle of infrared apparatus is discussed, and specific attention is given to the UR-10 infrared spectrometer made by the Karl Zeiss Company of Jena, East Germany. C.L.W.

N66-29491# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
NEUTRON-ACTIVATION ANALYTICAL DETERMINATION OF RADIO SENSATIONS [NEUTRONENAKTIVIERUNGS-ANALYTISCHE BESTIMMUNG VON RADIOSENSIBILISATOREN]
H. Altmann, H. Frischauf, D. Adamiker, and K. Kaindl 1966 23 p refs In GERMAN Presented at 7th Intern. Symp. on Radioactive Isotopes in Clinics and Research, Bad Gastein, Austria
(SGAE-BL-17/1966) CFSTI: HC $1.00/MF $0.50

The radiation sensitization mechanics of halogenic pyramidines and organic mercury compounds able to block the formation of SH-groups, were studied by neutron activation analyses after exposure. Biological materials containing chlorpyramidine compounds were exposed to 20 sec. of thermal neutron flux at 4×10^{12} n/cm^2 sec. Gamma-radiation analysis for the Cl^{38} nuclide showed an error of about ±28%, probably caused by the natural chloride traces in the biological materials. The same neutron irradiation of biological samples containing Br compounds for 2 hrs, followed by chemical preparation of the material, gave good results for Br^{82} with only a ±7% error range. Protein fractionation of irradiated biological substances containing activated Hg^{197} and subsequent γ-radiation analysis successfully determined traces of 0.001 μg Hg with an error of ±12%.
Transl. by G.G.

N66-29493# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Chemie.
DETERMINATION OF CONTAMINATION IN RED PHOSPHORUS BY NEUTRON ACTIVATION AND GAMMA SPECTROMETRY [BESTIMMUNG VON VERUNREINIGUNGEN IN ROTEM PHOSPHOR DURCH NEUTRONENAKTIVIERUNG UND GAMMASPEKTROMETRIE]
P. Patek and H. Sorantin Mar. 1966 20 p refs In GERMAN Submitted for Publication
(SGAE-CH-31/1966) CFSTI: HC $1.00/MF $0.50

In six samples of red phosphorus of different origin trace elements were determined by nondestructive neutron activation analysis. Only those nuclides were analyzed, which have a half-life shorter than 15 hours. Qualitatively 7 elements were detected, some of them were analyzed quantitatively, comparing their activity with simultaneous irradiated standards. Larger differences in the amount of trace elements in the different phosphorous samples could be observed. Sodium and aluminum were the most important contributants to the impurity level. Author

N66-29521*# Vermont Univ., Burlington.
CHANGES IN PHOTOELECTRIC WORK FUNCTION OF MOLYBDENUM DUE TO ADSORPTION OF CARBON MONOXIDE
John Dean Clewley (M.S. Thesis) Apr. 1966 50 p refs
(Grants NsG-241; NGR-46-001-008)
(NASA-CR-75865) CFSTI: HC $2.00/MF $0.50 CSCL 07D

The photoelectric work function of a polycrystalline molybdenum sample in both the clean state and during chemisorption of carbon monoxide is found experimentally. The experimental procedure is outlined and results are compared to previous work and predicted values. A decrease in the rate of change of work function of molybdenum upon exposure to carbon monoxide after ion bombardment is attributed to mechanical roughening of the surface during bombardment. Background discussion is presented in the fields of adsorption, surface physics and photoelectric measurements. The change in surface potential due to the addition of a dipole layer is calculated. Author

N66-29524*# Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
MASS SPECTROMETRIC STUDY OF THE PRODUCTS OBTAINED FROM FAST CRYOGENIC QUENCHING OF SEVERAL REACTIONS INVOLVING ATOMIC HYDROGEN OR ATOMIC OXYGEN
Donald Bernard Bivens (Ph.D. Thesis) May 1966 129 p refs
(Grant NsG-337)
(NASA-CR-75871) CFSTI: HC $4.00/MF $1.00 CSCL 07C

The reactions of hydrogen and oxygen atoms with several simple compounds followed by rapid quenching to cryogenic temperatures have been studied with the use of a low temperature inlet system to a mass spectrometer. The systems studied were the reactions of oxygen atoms with ammonia, acetylene, ethylene, and ethane; and the reaction of hydrogen atoms with nitric oxide. The atoms were produced by means of an efficient radio frequency electrodeless electric discharge arrangement which consisted of a 50-turn copper coil and an impedance matching network. The network insured the maximum power transfer from the transmitter to the plasma and hence, maximum production of atomic species. The resulting mixture of atomic and molecular species contacted a second gaseous reactant in a pyrex reactor cooled to very low temperatures, thereby resulting in fast quenching of the reaction products. The quenching temperature was varied from 77° to 100°K and the reactions occurred in a pressure range of 0.5 to 2.5 mm Hg. The low temperatures were produced by immersing the reactor in a dewar of a suitable liquid refrigerant. Author

N66-29527# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
THERMODYNAMIC PROPERTIES OF SOME FLUORIDE SYSTEMS
N. L. Lofgren and E. J. Mc Iver Mar. 1966 27 p refs
(AERE-R-5169)

Solid state galvanic cells using the fluorides of magnesium, nickel–iron, and uranium in various combinations were constructed and their thermodynamic properties observed. By combining the enthalpy of reactions obtained through applying the second law relation with the enthalpy of formation at 298°K of MgF_2, the enthalpy of formation of the cell components can be computed after extrapolation of the data to 298°K. The experimental entropies can be used in combination with the entropy of formation of MgF_2 to compute the entropies of formation of the fluorides used in the cells. Because the results agree with independently determined values, good support is given for the presumption that the cells yielded significant thermodynamic constants and that electronic conduction is unimportant. Problems associated with the design and operation of solid state galvanic cells are also discussed. Author

N66-29554# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
IDENTIFICATION OF SULFUR COMPOUNDS IN PETROLEUM. ANALYSIS OF A WASSON, TEXAS, CRUDE OIL DISTILLATE BOILING FROM 111°–150°C
Harold J. Coleman, C. J. Thompson, R. L. Hopkins, and H. T. Rall 1966 28 p refs
(BM-RI-6803)

Knowledge of the types of naturally occurring sulfur compounds in petroleum is of both theoretical and practical interest to petroleum chemists and geologists. This knowledge has been extended by the identification of 77 sulfur compounds, including 36 thiols, 23 chain sulfides, and 18 cyclic sulfides in a 111° to 150°C boiling range distillate of Wasson, Texas, crude oil. The characterization procedure used in separating and identifying these compounds included isothermal distillation, vacuum fractionation, liquid–solid chromatography (alumina adsorption), chemical treatment, gas–liquid chromatography, microdesulfurization, and infrared analysis. The procedural steps described represent a systematic method of sulfur compound analysis considered applicable for determining the nature and concentration of the sulfur constituents present in any straight-run petroleum distillate of the above-boiling range. Author

N66-29585# Los Alamos Scientific Lab., N. Mex.
SEPARATION AND SPECTROPHOTOMETRIC MEASUREMENT OF LOW CONCENTRATIONS OF TANTALUM
G. R. Waterbury, L. E. Thorn, and R. C. Kelly 9 Mar. 1966 15 p refs
(Contract W-7405-ENG-36)
(LA-3465) CFSTI: HC $1.00/MF $0.50

The spectrophotometric method for determining 25 to 100 μg of tantalum in uranium or plutonium alloys was modified to apply to the measurement of 5 ppM or greater of tantalum. The main changes were an increase in sample size to a maximum of 5 grams and a preliminary separation of the tantalum by extraction from a 6 M hydrochloric–0.8 M hydrofluoric acid solution of the sample into hexone. A major part of the selectivity of the method depends upon a second extraction of the tantalum from 6 M sulfuric–0.4 M hydrofluoric acid solution into hexone to effect separation from metals coextracted from the hydrochloric–hydrofluoric acid solution. The spectrophotometric measurement is based upon a color formed by tantalum with hydroquinone in 18 M sulfuric acid. The molar absorptivity of the tantalum–hydroquinone compound was 3650 at a wavelength of 375 mμ. An average for the tantalum found of 99% and relative standard deviations of 13 and 11% were obtained for 32 analyses of solutions containing 4.80 grams of plutonium and either 25 or 50 μg (5 or 10 ppM) of tantalum. An average for the tantalum found of 100% and relative standard deviations of 5.0, 2.0, and 1.3% were obtained for 42 analyses of solutions containing 1 gram fo plutonium and 50, 100, and 500 μg (50, 100, and 500 ppM) of tantalum, respectively. Titanium, molybdenum, and niobium cause interference in this method. Author (NSA)

N66-29598# Illinois Univ., Urbana. Dept. of Chemistry and Chemical Engineering.
CARBON-13 MAGNETIC RESONANCE OF DIENE–IRON TRICARBONYL COMPLEXES
H. L. Retcofsky (Bur. of Mines, Pittsburgh), E. N. Frankel (Agr. Res. Serv., Peoria, Ill.), and H. S. Gutowsky 6 Mar. 1966 17 p refs Submitted for Publication
(Contract Nonr-1834(13))
(TR-89; AD-630078) CFSTI: HC $1.60/MF $0.50

The C13 nmr spectra of butadiene–iron tricarbonyl and methyl octadecadienoate–iron tricarbonyl were obtained to elucidate the structure of these complexes. The C13-H coupling constants indicate that all of the C-H bonds in the butadiene complex are essentially sp2 hybrids. This observation, the C13 and proton chemical shifts, the H,H coupling constants and other data are consistent with a structure in which the bonding of Fe at C-2,3 in the diene complexes is very similar to that in ferrocene, but in which the terminal CH2 or CHR groups are rotated about the C1-C2 and C3-C4 bonds of the ligand. This steric distortion of the ligand from planarity makes the bonding of the Fe at C-1,4 differ somewhat from that at C-2,3, but both instances involve π orbitals on the carbons. Author (TAB)

N66-29620# Institutt for Atomenergi, Kjeller (Norway).
RADIOCHEMICAL AND NUCLEAR STUDIES OF THE SHORT-LIVED FISSION PRODUCTS ^{145}Ce, ^{146}Ce, AND ^{147}Ce
D. C. Hoffman and O. B. Michelsen Dec. 1965 60 p refs
(KR-76)

A procedure based on extraction by di-(2-ethylhexyl) orthophosphoric acid (HDEHP) was developed for the rapid separation of Ce from fission products and also (through extraction chromatography) for the continuous separation of Pr activities from their parent activities. The latter procedure permits the observation of radiocerium with a minimum of interference from its daughters. The decay properties of ^{145}Ce, ^{146}Ce, and ^{147}Ce were studied by gamma and beta scintillation spectrometry and by gamma-gamma, gamma-beta, and beta-gamma coincidence measurements. Information was obtained on half lives, gamma and beta energies, and the relative intensities of gamma rays. Decay schemes are proposed for ^{146}Ce and ^{145}Ce. The decay of ^{147}Ce was observed directly for the first time, and its half life was determined by both gamma and beta decay measurements. However, attempts to single out specific gamma or beta energies for this nuclide failed. A search for a possible ^{146m}Pr gave no definite results. Author (NSA)

N66-29672# Princeton Univ., N. J. Frick Chemical Lab.
INFRARED AND RAMAN SPECTRA OF CARBON SUBOXIDE IN CONDENSED PHASES
William Hayden Smith and George E. Leroi Jan. 1966 43 p refs Submitted for Publication
(Contract Nonr-1858(48))
(TR-2; AD-631999) CFSTI: HC $2.00/MF $0.50

Infrared and Raman spectra of liquid, crystalline, and matrix isolated carbon suboxide have been obtained in the region 20 to 4000 cm^{-1}. A previously unreported solid-solid transition has been observed at 115±5°K, and possible structures for both crystalline phases have been inferred from the spectroscopic results. The π_u central carbon bending mode, ν_7, has been identified in the liquid phase at 72±2 cm^{-1}. The problem of 'disappearing' sum bands is discussed, and a revised vibrational assignment and force constant analysis for carbon suboxide is presented. Author (TAB)

N66-29673# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS-CHROMATOGRAPHIC ANALYSIS OF ORGANIC COMPOUNDS

Tieh-Tsen Lin 15 Mar. 1966 24 p refs Transl. into ENGLISH from Hua Hsueh T'ung Pao (Peking), no. 2, 1964 p 1-7 (FTD-TT-65-684/1+2+3+4; AD-631835) CFSTI: HC $1.00/MF $0.50

The applications of gas chromatography in organic analysis, especially of combustion products, is reviewed. Topics include: Quantitative analysis of organic compounds by gas chromatography (simultaneous determination of C and H, two methods of determining N, two methods of determining S, determination of O, simultaneous determination of several elements); basic studies on application of gas-chromatography to analysis of compounds (combustion of samples, judging the capabilities of oxidizing agents, rinsing of combustion products); sources of errors. TAB

N66-29717# Union Carbide Nuclear Co., Tuxedo, N. Y.
RESEARCH IN ACTIVATION ANALYSIS Final Report, 1 Aug. 1963-31 Oct. 1964
H. Arino, H. H. Kramer, V. J. Molinski, R. S. Tilbury, W. H. Wahl et al Washington, AEC, 31 Dec. 1964 143 p refs (Contract AT(30-1)-2975)
(NYO-10175) CFSTI: HC $4.00/MF $1.00

Improved radiochemical procedures and neutron activation analysis techniques were developed and are described. A rapid activation analysis method was developed for the simultaneous determination of microgram amounts of tantalum and niobium in various sample materials. Another rapid method was developed for use in determining microgram amounts of magnesium in ores and blood serum. None of these analyses requires more than 30 minutes to complete. Solvent extraction and precipitation were used in the radiochemical separations. Radiochemical procedures were developed to separate sequentially the multiple components of a radioactive mixture. The results show that as many as 12 different neutron-induced radioactive species can be separated from a single neutron-activated sample in just a few hours. The method is capable of determining many more radionuclides in the same sample material, and can be adapted for use as part of an automated separation system for routine laboratory use, either in activation analysis or for fission-product assays. The basic radiochemistry involves ion-exchange resin separations. The method was used to determine many elements in different kinds of sample materials. For example, parts-per-million of W, Cu, Co, Mn, Na, Zn, Ta, Sc, and Sb, and macro amounts of Cr and Fe were determined in ores and minerals. Similar techniques were also used to separate radioelements such as ^{46}Sc, ^{59}Fe, ^{60}Co, and ^{65}Zn from other species and from each other before radioactivity measurement by gamma scintillation spectrometry. Research was also continued in the use of metastable isomers as activation analysis indicators. Nuclear isomers of Zn, Y, Pd, Sn, Ba, Er, Os, Ir, Pt, Ta, and Au were found to be more sensitive indicators under certain conditions than many of the radionuclides normally used. In all instances, the use of cadmium-covered specimens and short irradiations (usually for a few minutes) were used to advantage. Experiments were carried out to detect short-lived isomeric states of Cl, Zr, Ca, and Fe. Nuclear isomers of Cl and Zr, viz., ^{38m}Cl(0.74 sec) and ^{90m}Zr(0.80 sec), are known to exist, but were not detected. No new short-lived radioactivities were found for Ca or Fe. Reactor activation cross sections and cadmium ratios were measured for 29 different nuclear reactions, and new cross-section values were obtained for ^{131m}Ba, ^{89m}Y, ^{197m}Au, ^{191m}Ir, and ^{167m}Er. NSA

N66-29728*# National Aeronautics and Space Administration, Washington, D. C.
DIFERROCENYLS AND TERFERROCENYLS [DIFERROTBENILY I TERFERROTSENILY]
A. N. Nesmeyanov, V. N. Drozd, V. A. Sazonova, V. I. Romaenko, A. K. Prokof'yev et al May 1966 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Khim. Nauk (Moscow), no. 4, 1963 p 667-674
(NASA-TT-F-10175) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Methods for synthesizing a series of substituted diferrocenyls, 1,1'-diferrocenylferrocene (1,1'-terferrocenyl), and polyferrocenylenes are described in detail. The system of two linked cyclopentadienyl nuclei in the molecule of diferrocenyls absorbs in the infrared region near 1000 and 1113 cm^{-1}, which is close to the absorption frequencies of the unsubstituted cyclopentadienyl ring of ferrocene and its derivatives. It was concluded that the Ullmann reaction in the ferrocene series proceeds in the standard manner, without isomerization. Polyferrocenylenes of a definite structure were synthesized from halogen ferrocenes by the Ullmann reaction, and their properties were investigated. The frequencies of 1000 and 1113 cm^{-1} recorded for the spectra of the disubstituted diferrocenyls lacking a free cyclopentadiene ring are inherent to a system of interconnected cyclopentadienyl nuclei. S.P.

N66-29755*# Idaho State Univ., Pocatello. Dept. of Chemistry.
THE REACTIONS PERTAINING TO ZINC-SILVER AND CADMIUM-SILVER BATTERIES First Quarterly Report
G. Myron Arcand 17 May 1966 20 p refs Prepared for JPL (Contracts NAS7-100; JPL-951458)
(NASA-CR-76047) CFSTI: HC $1.00/MF $0.50

Zn(II) was precipitated from tritiated solutions with KOH and NH_3. Precipitates formed with KOH contained little activity while those formed with NH_3 contained considerable activity. These observations, combined with the results of thermogravimetric experiments, suggest that ZnO is formed by KOH and $Zn(OH)_2$ by NH_3. Thermogravimetric behavior of AgO depends on whether the oxide is formed chemically or electrochemically. There is evidence that AgO decomposes rapidly at 140°C. Auth

N66-29762*# Sperry Rand Research Center, Sudbury, Mass.
DEVELOPMENT OF CHEMICAL ANALYSIS TECHNIQUES FOR ADVANCED MATERIALS RESEARCH PROGRAM Third Quarterly Progress Report, Jun. 1-Aug. 31, 196
Fredric D. Leipziger [1965] 17 p Prepared for JPL (Contracts NAS7-100; JPL-950992)
(NASA-CR-76030; SRRC-RR-65-79) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The period was devoted to the analysis of MgO powders and compacts. These analyses include mass spectrographic impurity analyses, emission-spectrographic checks of metallic impurity levels, and hot extraction hydrogen analyses. Several problems have arisen with respect to mass spectrographic analyses. Briefly, these involve surface contamination and difficulties in the analysis of insulating compacts. The surface contamination problem has been resolved by a combination of baking and presparking. The method used for the analysis of compacts is not yet in reliable condition. In order to obtain any analyses for these materials we have had to resort to grinding techniques. Auth

N66-29763# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERS CONSISTING OF AROMATIC RINGS CONJUGATED WITH HETEROATOMS

V. I. Nikitina, A. I. Maklakov et al 30 Mar. 1966 12 p refs Transl. into ENGLISH from the publ. "Vysokomolekulyarnyye Soyedineniya; Geterotsepnyye Vysokomolekulyarnyye" Moscow, Izd.-vo Nauka, 1963 p 87–90
(FTD-TT-65-1355/1+2+4; AD-631567) CFSTI: HC $1.60/MF $0.50

Polymers were obtained by polycondensation of aromatic diamines and diatomic phenols. The polymer chains consisted of polyphenyleneimines and other conjugated ring systems containing nitrogen atoms. The electrical and magnetic properties of the polymers obtained were investigated. All specimens possess increased electrical conductivity, have positive, static magnetic susceptibility, and reveal signals of EPR in the basic state. Author (TAB)

N66-29764# American Meteorological Society, Boston, Mass.
DETERMINATION OF THE FORM OF DIAMOND CRYSTALS FROM THEIR ATOMIC STRUCTURE [VYVOD FORMY KRISTALLOV ALMAZA NA OSNOVE IKH ATOMNOGO STROENIIA]
O. M. Ansheles Bedford, Mass., AFCRL, Jan. 1966 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 101, no. 6, 1955 p 1109–1112
(Contract AF 19(628)-3880)
(T-R-584; AD-631969) CFSTI: HC $1.00/MF $0.50

An examination is made of how the principal faces, namely, the cube, rhombic dodecahedron, and octahedron, should grow and tangentially expand on a diamond crystal and what habit of natural diamond should be obtained in the process. TAB

N66-29773# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CHEMICAL ANALYSIS OF SPENT POWER REACTOR FUELS
F. P. Roberts and H. H. Van Tuyl 27 Dec. 1965 7 p refs Presented at Am. Nucl. Soc. Topical Meeting on Large-Scale Production and Appl. of Radioisotopes Augusta, Ga., 20–23 Mar. 1966 Submitted for Publication
(Contract AT(45-1)-1830)
(BNWL-SA-503; CONF-660305-11) CFSTI: HC $1.00/MF $0.50

The isotopic composition of Pm in typical spent power reactor fuels was evaluated. Also, the amounts of a number of fission product and heavy element isotopes were determined for the purpose of lending factual support for calculations of the value of these isotopes in spent reactor fuels. Four samples of fuel from the Yankee Reactor (a typical pressurized water reactor) and three from the Vallecitos Boiling Water Reactor were analyzed. The results showed that Pm from power reactors of the type studied will not contain intolerable amounts of ^{146}Pm. For the worst case (Yankee), the Pm would require no more shielding than ^{238}Pu for many source sizes and applications. Data from the analyses of actinide elements and pertinent fission products in the fuels provide a basis for predicting the production rates of various reactor by-products. NSA

N66-29776# Oak Ridge National Lab., Tenn.
VAPOR PRESSURES OF GASEOUS PRODUCTS FROM CHEMICAL REACTIONS OF SOL-GEL FUELS
T. A. Gens 10 Feb. 1966 13 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1418) CFSTI: HC $1.00/MF $0.50

Calculations were made on the partial pressures of gases expected to be formed in various reactor fuel materials. The calculations are based on data from the chemical literature. The CO pressure due to reaction between coating and oxide inside carbon-coated UO_2 and ThO_2 microspheres will reach 450 psi when the temperatures are 2400° and 2300°C, respectively. Nitrogen pressures from thermally decomposing UN and PuN microspheres will reach equilibrium values of 450 psi at 3000° and 2800°C, respectively. This is the helium pressure expected in the TARGET gas-cooled reactor. Therefore, it appears that these coated fuel microspheres would not develop excessive internal pressures at the pressure and respective temperatures listed above. Pressures expected at other temperatures are also tabulated. Author (NSA)

N66-29777# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SORPTION OF ^{90}Sr ON AN ALUMINUM OXIDE [SORPTION DU ^{90}Sr SUR UN OXYDE D'ALUMINIUM]
Roger Rzakiecki Nov. 1965 59 p refs In FRENCH
(CEA-R-2851)

The sorption mechanism of an alkaline earth bivalent cation on activated aluminum oxide was compared to the sorption mechanism of a monovalent ion. The selective retention of the alkaline earth cation was used to remove trace amounts of ^{90}Sr from radioactive waste waters. A kinetic study is reported, leading to the calculation of an industrial column. Author (NSA)

N66-29781# Utah Univ., Salt Lake City. Inst. of Metals and Explosives Research.
ATTEMPTED DETERMINATION OF NITRATE IN FIRED THORIA USING INFRARED TECHNIQUES Technical Report No. 27
C. S. Olsen, F. A. Olson, and M. E. Wadsworth 1 Sep. 1965 12 p refs
(Contract W-7405-ENG-26)
(TID-22505) CFSTI: HC $1.00/MF $0.50

Using infrared spectroscopy, a quantitative method of determining nitrate in fired thoria was attempted. The KBr pellet technique was based upon the conversion of a covalent nitrate in the thoria to an ionic nitrate. This method was unsuccessful because the exchange was not quantitative. Mull methods were also unsuccessful due to the low concentration of nitrate in thoria and low absorbance of the nitrato bands. Author (NSA)

N66-29783# Hopital St. Pierre, Louvain (Belgium). Laboratoire de Recherches de la Clinique Medicale.
INFLUENCE OF MOLECULAR STRUCTURE ON THE DECOMPOSITION OF STEROIDS IN SOLUTION BY AUTO-IRRADIATION [INFLUENCE DE LA STRUCTURE MOLECULAIRE SUR LA DECOMPOSITION PAR AUTO-IRRADIATION DES STEROIDES EN SOLUTION]
P. Osinski Brussels, EURATOM, 1965 14 p In FRENCH
(Contract EURATOM-040-63-9 RISB)
(EUR-3435.f)

The influence of molecular structure on the decomposition of steroids in solution by auto-irradiation was investigated. The steroids were deposited in different conditions in regard to solvent, temperature, and radioactive concentration. It was noted that as the oxygen atoms contained in the molecules tend to increase in number, they have an adverse effect on the storage of the steroids, irrespective of the position of the groups which carry this oxygen. The various structures of the A-nucleus did not seem to have any effect on the

nature and degree of decomposition of the tritiated products. In order to study the way in which the decomposition of tritiated steroids is affected by the structure of the side-chain, comparisons were made between hydrocortisone and cortexolone on one hand and corticosterone and deoxycorticosterone on the other. These two pairs of steroids differ only by the presence of a hydroxyl group in the 11 position in the hydrocortisone and corticosterone molecules, this group being absent in the cortexolone and deoxycorticosterone molecules. The presence of the hydroxyl group is favorable to the storage of hydrocortisone, whereas on the other hand the decomposition of corticosterone is more pronounced than that of deoxycorticosterone. The storage properties of corticosterone are inferior to those of aldosterone, whose molecule contains an aldehyde group in the 18 position, whereas in the corticosterone molecule this position is occupied by a methyl.

Author (NSA)

N66-29788# Illinois Univ., Urbana.

MOSSBAUER STUDIES OF DIVALENT AND TRIVALENT Fe^{57} IN $CoSO_4$ AND $CoSO_4 \cdot 7H_2O$

R. Ingalls, C. J. Coston, G. De Pasquali, H. G. Drickamer, and J. J. Pinajian (Oak Ridge Natl. Lab.) [1966] 22 p refs (Contracts AT(11-1)-1198; Nonr-1834(05))

(COO-1198-355; AD-631481) CFSTI: HC $1.60/MF $0.50

Results are reported of a Mossbauer study of $Co^{57}(Fe^{57})$ in $CoSO_4$ as a function of temperature at atmospheric pressure and as a function of pressure at room temperature. In addition to the expected divalent Fe^{57} component, a trivalent component was also observed, the relative intensity of which decreases with increasing temperature or pressure. The isomer shifts of both charge states also decrease with increasing temperature or pressure. The behavior of the large quadrupole splittings observed in each charge state is analyzed using the crystal field approximation. Similar results were also found in a temperature study of $CoSO_4 \cdot 7H_2O$ at atmospheric pressure. The relative intensity of the trivalent Fe^{57} component is considerably greater in the hydrate and also decreases with increasing temperature.

Author (TAB)

N66-29789# Rocket Power, Inc., Pasadena, Calif.

RESEARCH ON CHEMICAL SYNTHESIS WITH MONOENERGETIC IONS Final Technical Report, 1 Oct. 1964–30 Sep. 1965

C. Barter 22 Apr. 1966 26 p refs

(Contract AF 49(638)-1457)

(AFOSR-66-0703; AD-631677) CFSTI: HC $2.60/MF $0.50

A reaction system was developed which is based on the concept that select chemical products can be formed if ions and molecules are brought together in controlled manner. The system was employed for the study of NO_2 ion and benzene. Numerous exploratory fluorine chemistry experiments were carried out. In connection with the latter it was found that highly reactive, neutral, ion reaction products are capable of storage at liquid nitrogen temperatures, and may be used for reagent purposes.

Author (TAB)

N66-29790# Little (Arthur D.), Inc., Cambridge, Mass.

SOUND PROPAGATION AND PRESSURE-INDUCED STRUCTURAL CHANGES IN SEA WATER

R. A. Horne and H. F. Eden 30 Apr. 1966 32 p refs (Contract Nonr-4424(00))

(TR-21; AD-631807) CFSTI: HC $2.00/MF $0.50

The application of hydrostatic pressure is more effective in destroying the Frank–Wen clusters in bulk liquid water and in breaking up the local water structure in the hydration atmospheres of ionic species in solution than is the application of temperature. In addition, as a consequence of electrostriction, the application of pressure increases the dissociation of weak electrolytes such as magnesium sulphate. While having relatively little effect on the velocity of sound in sea water, these processes are responsible for the absorption of acoustic energy in the sea. Author (TAB)

N66-29792# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Physics.

CONSECUTIVE ION–MOLECULE REACTIONS IN ETHYLENE INVESTIGATED BY MEANS OF POSITIVE ION-IMPACT Scientific Report No. 5

I. Szabo 15 Feb. 1966 37 p refs

(Contract AF 61(052)-762)

(AFCRL-66-295; AD-632559) CFSTI: HC $2.00/MF $0.50

The ion–molecule reactions in ethylene C_2H_4 were studied in detail up to fourth order processes in the pressure range 0.00008 to 0.0013 mm Hg. The intensities of the peaks are plotted as a function of the pressure. From the graph, the order and mechanisms of the formation of the product ions can be determined as a function of the energy absorbed by the molecule during the charge exchange. The ion–molecule reactions are discussed and some new processes are proposed.

Author (TAB)

N66-29859# Army Natick Labs., Mass. Clothing and Organic Materials Div.

NITROSO RUBBER HANDBOOK Technical Report, Jan. 1957–Dec. 1965

Malcolm C. Henry and Charles B. Griffis Jan. 1966 68 p refs *Its* Tech. Rept.-66-2-CM

(CEOM-15; AD-632196) CFSTI: HC $3.00/MF $0.75

Contents: Terminology and Nomenclature; Historical Development; Nitroso Rubber Chemistry (Monomer Synthesis; Polymerizations; Pilot Plant Set-up; Basic Polymer Property Studies); Properties of Nitroso Rubber; Compounding Studies; Future and Potential Uses of Nitroso Rubber. TAB

N66-29867*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SHOCK-TUBE INVESTIGATION OF BROMINE DISSOCIATION RATES IN PRESENCE OF ARGON, NEON, AND KRYPTON

Marvin Warshay Washington, NASA, Jul. 1966 26 p refs (NASA-TN-D-3502) CFSTI: HC $1.00/MF $0.50 CSCL 07D

A shock tube with an all-glass driven section was employed to obtain dissociation rates of bromine in dilute mixtures (1 percent) with three noble gases (argon, neon, and krypton). All rate measurements were made behind incident shocks. The temperature range was 1200° to 1900°K. For bromine, poor quality shock-tube data resulted from difficulties involving three critical areas: materials of construction, light absorption measurements, and temperature drop during dissociation. Experimental difficulties were overcome by using a carefully designed apparatus and procedure. This investigation provided entirely new data on the rates of dissociation of bromine in the presence of neon and of krypton, as well as more reliable dissociation rates of bromine in argon. These data helped in the evaluation of the abilities of five theoretical models to predict halogen dissociation-recombination rates in the presence of noble gases. However, one apparent defect

that all models have is the inability to predict the bromine experimental activation energy E_a, which for the simple collisional kinetic form of the dissociation-rate constant is less than the dissociation energy D_0. This situation exists because E_a is assumed to equal D_0. Author

N66-29926# State Univ. of New York, Stony Brook. Dept. of Materials Science.
THE THERMAL DECOMPOSITION OF IRRADIATED MATERIALS
Joseph Jach 1 Mar. 1966 92 p refs Submitted for Publication
(Contract Nonr-4673(00))
(TR-2; AD-631997) CFSTI: HC $3.00/MF $0.75

A study was made of the influence of irradiation on the thermal decomposition of solid compounds. The article is divided into three sections. The first is a summary of present day knowledge of decompositions of unirradiated solids. These are the basic control experiments and the main purpose of this section is to familiarize the reader with the basic language of the field. The second section deals with the influence of irradiation itself, while the third section examines very briefly some related topics. TAB

N66-29928# American Cyanamid Co., Stamford, Conn. Central Research Div.
CHEMILUMINESCENT MATERIALS Progress Report No. 11, 1 Dec. 1965–28 Feb. 1966
M. M. Rauhut, L. J. Bollyky, D. R. Maulding, R. A. Clarke, B. G. Roberts et al 31 Mar. 1966 50 p refs
(Contract Nonr-4200(00); ARPA Order 299)
(TR-06-1432-26-Q11; AD-632220) CFSTI: HC $4.60/MF $0.50

Progress toward the development of efficient chemiluminescent systems is reported. Nine new oxalate esters and nine oxamides were prepared and examined-qualitatively for chemiluminescence. Six of the esters and two oxamides gave medium or better chemiluminescent intensities when reacted with hydrogen peroxide and 9, 10-diphenylanthracene. Strong chemiluminescence was observed for two esters which represent new sub-classes of chemiluminescent oxalates. One of these requires acid catalysis and permits lifetime variation through pH control. A different, but partially overlapping, set of nine oxalate esters was examined quantitatively for chemiluminescence efficiency and lifetime in several solvents under a variety of conditions. Bis(2,4-dinitrophenyl) oxalate provided a quantum yield of 16.5% in dilute solution; five other esters gave quantum yields above 12%; and two others gave quantum yields in the 8 to 10% range. In every case, however, the quantum yield decreased with increasing ester concentration so that maximum radiation capacities were obtained at concentrations near 0.01 M. It was found that a large range of emission lifetimes can be achieved depending on the structure of the ester and the choice of reaction condition. TAB

N66-29937# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE FORMATION OF THE TETRAGONAL BORON MODIFICATIONS BY SUBSTITUTION OF THE BERYLLIUM ATOM IN THE BeB_{12} LATTICE
H. J. Becher 15 Mar. 1966 14 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Leipzig), no. 321, 1963 p 217–223
(FTD-TT-65-798/1+2+4; AD-631994) CFSTI: HC $1.00/MF $0.50

By heating BeB_{12} with BC_{13} in a closed tube, Be is substituted by B without changing the crystal structure. The obtained boron is of >99% purity and tetragonal structure. By this reaction the structural relation between BeB_{12} and the tetragonal boron modification was proved. IR examinations of α-boron, tetragonal boron and BeB_{12} allowed the assignment of internal vibrations of the B_{12}-icosahedrons and of lattice vibrations. Author (TAB)

N66-29943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTICHOLINESTERASE PROPERTIES OF SOME O-ETHYL S-ALKYL METHYLTHIOPHOSPHONATES. 2. KINETICS OF INHIBITION OF CHOLINESTERASE AND ACETYLCHOLINESTERASE BY O-ETHYL S-n-ALKYL METHYLTHIOPHOSPHONATES
Ye. V. Rozengart, Ye. I. Godyna, and N. N. Godovikov. 29 Apr. 1966 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk Ser. Khim. (SSSR), no. 8, 1965 p 1370–1375
(FTD-HT-66-194/1+2+4) CFSTI: HC $1.00/MF $0.50

The kinetics of the interaction of O-ethyl S-n-alkyl methylthiophosphonates with horse serum cholinesterase and bovine erythrocyte acetylcholinesterase was investigated. The water-alkyl hydrolysis constants of the studied compounds were determined. The anticholinesterase activity of the O-ethyl S-n-alkyl methylthiophosphonates strongly depends upon the length of the alkyl radical. Author (TAB)

N66-29953# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
MACHINE COMPUTATION OF ESR SPECTRA Final Report, 15 Apr. 1965–1 Jan. 1966
L. A. Harrah, R. C. Waggoner, and D. J. Dunbar Feb. 1966 64 p refs
(AEML-TR-66-18; AD-632523) CFSTI: HC $3.00/MF $0.75

Three computer programs are given for the calculation of theoretical ESR spectra with M_I variations in line width, up to six independent coupling constants, and combinations of two distinct species. Spectra are reported for the case of two identical nuclei of spin 1/2 and a second nonequivalent nucleus of spin 1/2 with varying line widths and changing ratios of the two coupling constants. Author (TAB)

N66-29954# Weizmann Inst. of Science, Rehovoth (Israel).
PRESSURE SHIFTS OF INFRARED LINES, LOW-TEMPERATURE SPECTRA OF MOLECULES, AND TECHNIQUES OF INTERFERENCE SPECTROSCOPY Annual Summary Report, 1 Jan.–31 Dec. 1965
J. H. Jaffe and S. Kimel Jan. 1966 7 p refs
(Contract AF 61(052)-838)
(AFCRL-66-261; AD-632130) CFSTI: HC $1.00/MF $0.50

Brief summaries are given of progress and results in the following phases of infrared spectroscopy research (numbers indicate AD reports in which detailed accounts are given): Study of Pressure Induced Shifts of Vibration; Rotation Lines of Polar Gases (AD-626 202); Measurement of the Refraction Spectrum Through Individual Vibration–Rotation Lines (AD-628 779); Study of Intermolecular Forces by Means of Low-Temperature Spectroscopy (AD-628 750); Investigation of Noise and Errors in Fourier-Transform Spectroscopy; Study of Width and Shift of Far-Infrared Lines; Theoretical Investigation Complementing the Experimental Work (AD-627 042). TAB

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-28441# Joint Publications Research Service, Washington, D. C.
OPTIMAL USE OF MULTI-CHANNEL SYSTEMS FOR SEPARATION OF REGULAR SIGNALS FROM NOISE
I. A. Bol'Shakov and B. A. Grishanin *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 140–151 refs (See N66-28428 16-10) CFSTI: $6.00

The problem of optimal use of the outputs of multichannel detection systems for the reception of regular signals in noise is investigated. Operators are defined for optimal interchannel processing, their detection and measurement characteristics are investigated. A comparison is made to nonoptimal methods of using multi-channel systems. Author

N66-28445# Joint Publications Research Service, Washington, D. C.
A DISCRETE SELFADJUSTING TRACKING SYSTEM
V. I. 'Kostyuk *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 181–191 refs (See N66-28428 16-10) CFSTI: $6.00

Discrete tracking systems are investigated at the input of which we supply a stationary random useful signal and noise. For a sufficiently small change in the signal-noise ratio the selfadjusting system provides for the least mean square pulse error. It is shown that just as for continuous systems, in the optimal discrete tracking system the spectral density of the total error does not depend on the frequency in the case of white noise type noise. In the selfadjustment circuit frequency filters are used. Author

N66-28449# Joint Publications Research Service, Washington, D. C.
THE DETERMINATION OF THE STATISTICAL CHARACTERISTICS OF A NONLINEAR TRACKING SYSTEM
A. M. Perel'man *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 228–240 refs (See N66-28428 16-10) CFSTI: $6.00

An approximate method for determination of the probability characteristics of mismatch under the steady state condition of operation of an astatic tracking system with modulation is discussed. The method is based on statistical linearization of the characteristics of the modulator and the amplitude detector. Author

N66-28468# Texas Instruments, Inc., Dallas.
SIGNAL DETECTION USING IMPULSE CROSS CORRELATION
S. W. Marshall and A. C. Keller (White Sands Missile Range) *In* NRL The Shock and Vibration Bull. Feb. 1966 p 105–119 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

A system has been developed and fabricated which displays the cross correlation function of an arbitrary signal with a periodic signal of selectable frequency. Based on the theory that the cross correlation function of an extremely noisy signal with a noise-free periodic signal contains no noise, and using the sampling property of the Dirac delta function, the relation has been physically implemented. Requiring a knowledge only of the fundamental frequency of the signal of interest (as obtained through autocorrelation spectrum analysis or other a priori information) the exact waveshape of any periodic signal may be recovered from a total noisy signal. Features of the system include frequency response from 2 cps to 100 kc and signal to noise enhancement of up to 53 dB. Author

N66-28471# Pratt and Whitney Aircraft, East Hartford, Conn.
SLOPE ERROR OF POWER SPECTRAL DENSITY MEASUREMENTS
Robert L. Gordon *In* NRL The Shock and Vibration Bull. Feb. 1966 p 135–138 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

An expression for the slope error in analog power spectral density analysis is developed. The error slope is defined as the difference between the true average of the power spectral density curve, and the approximate average value taken from the center frequency of the bandpass filters. It is pointed out that the slope error is usually less significant than the more widely used blurring error and the random process statistical error. However, it is shown that there are special situations in which the slope error may be more significant: (1) at very low frequencies, (2) in the analysis of lightly damped structures, and (3) when using low Q filters. N.E.N.

N66-28472# Measurement Analysis Corp., Los Angeles, Calif.
THE EFFECTS OF PHASE ERRORS UPON THE MEASUREMENT OF RANDOM PROCESSES
Ronald D. Kelly *In* NRL The Shock and Vibration Bull. Feb. 1966 p 139–150 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

Those types of analyses that are not affected by static phase errors in the measurement system, such as ordinary power spectral density and autocorrelation analyses, are briefly treated to demonstrate why they are not affected. In addition, the inaccuracies in these analyses from dynamic phase errors are discussed. It is the primary purpose of this paper, however, to examine those types of analyses that are affected by phase errors, such as cross spectral density and cross correlation. The resultant inaccuracies in the reduced data are presented for several typical kinds of phase errors, so that the phase characteristics of practical measurement systems can be quantitatively related to the accuracy of the reduced data. Author

N66-28484*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
ACCURACY OF APPROXIMATE FORMULATIONS FOR NEAR-FIELD WEDGE DIFFRACTION OF A LINE SOURCE
L. L. Tsai and R. C. Rudduck 15 Mar. 1966 35 p refs *Its* Rept. 1691-18
(Grant NsG-448)
(NASA-CR-75695) CFSTI: HC $2.00/MF $0.50 CSCL 20

The accuracies of two approximate formulations used in edge diffraction theory are checked. The formulations apply for the near-field diffraction of a cylindrical wave by a wedge. The approximate formulations are compared with the exact solution, which can be evaluated in the region where the approximations need to be checked. The approximate formulations are found to be accurate; errors are generally less than a few percent. Author

N66-28507*# Alabama Univ. Research Inst., Huntsville.
CUTOFF FREQUENCIES OF ECCENTRIC WAVEGUIDES
H. Y. Yee (Polytechnic Inst. of Brooklyn) and N. F. Audeh [1966] 30 p refs Submitted for Publication
(Grant NsG-381; Contract DA-01-021-AMC-14441(Z))
(NASA-CR-75727) CFSTI: HC $2.00/MF $0.50 CSCL 20N

The uniform cylindrical waveguide formed by placing one conductor inside a conducting tube is discussed. Because of the complexity of the guide's cross section, the numerical technique of the point-matching method is adopted to solve the boundary-value problem. The formulations are carried out for the case when each of the conductors has an arbitrary cross section and also for the case when one of the conductors has a circular cross section. The coaxial waveguide modes, in which the field components have angular variations, split into odd and even modes when the center conductor begins to shift axis to form the uniform eccentric waveguide. However, only even modes in the eccentric guide correspond to the coaxial modes with no angular variations. The dependence of the cutoff frequency on the eccentricity of the guide is determined numerically for even and odd transverse electric and transverse magnetic modes. Experimental results verify the theoretical calculations for transverse electric modes.
Author

N66-28513*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
AN EXPERIMENTAL FACILITY FOR SEQUENTIAL DECODING Technical Report No. 450
Charles W. Niessen 13 Sep. 1965 82 p refs Lincoln Lab. Tech. Rept. No. 396
(Grants NsG-334; NsG-496; NSF GP-2495; NIH G-MH-04737-05; Contract DA-36-039-AMC-03200(E) et al)
(NASA-CR-75566; ESD-TDR-65-442) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This report describes the system design and implementation of a facility for the experimental study of sequential decoding that may be used at M.I.T. by graduate researchers in communication theory. Flexibility and ease of use are the primary requirements of this system. Through investigation of the characteristics of sequential decoding and likely problems to be studied led to a system based upon the MAC PDP-6 computer. A portable data-acquisition system, consisting of a digital tape recorder and analog-to-digital conversion equipment, is provided to make available to the computer the outputs of experimental demodulation equipment. The experimenter can decode the acquired data sequentially in accordance with an algorithm specified and easily written by him in a version of Fortran modified for this purpose. A display system is used for man-machine interaction. The system has been successfully implemented and tested, and experimental results are described.
Author

N66-28817# Royal Aircraft Establishment, Farnborough (England).
SINGLE-STATION COVERAGE FOR EARTH-SATELLITE ORBITS
R. H. Merson Jan. 1966 23 p ref
(RAE-TR-66029) CFSTI: HC $1.00/MF $0.50

In coordinated studies of station siting and satellite orbit specification, an important factor is the frequency of occurrence of satellite passes over the station. This factor has a bearing for example on the accuracy with which the orbit can be determined, particularly in the case of a minimal tracking network. In this paper an algorithm is derived for determining the average number of passes per day of a satellite in a circular orbit of given height and inclination over a ground station having given latitude and acquisition angle. An approximate procedure for treating eccentric orbits is also given. Author

N66-28846# Systems Research Labs., Inc., Dayton, Ohio.
DETECTION AND CLASSIFICATION OF TRANSIENTS
Robert M. Colomb [1964] 40 p refs

CONTENTS:

1. NEW METHODS IN FUNCTIONAL ANALYSIS OF BIOMEDICAL DATA R. M. Colomb 4 p refs (See N66-28847 16-07)
2. VECTOR CLASSIFICATION BY PREDICTION TECHNIQUES 3 p ref
3. A PROBLEM AND A POSSIBLE SOLUTION IN ORTHONORMAL ANALYSIS OF DATA R. M. Colomb 6 p refs (See N66-28848 16-07)
4. METHODS OF DERIVING OPTIMAL ORTHONORMAL FILTER FUNCTIONS 8 p (See N66-28849 16-07)
5. DISCUSSION OF A GENERAL METHOD FOR RELATING FREQUENCY, ENERGY (OR AMPLITUDE) AND TIME 5 p refs (See N66-28850 16-07)

N66-28847# Systems Research Labs., Inc., Dayton, Ohio.
NEW METHODS IN FUNCTIONAL ANALYSIS OF BIOMEDICAL DATA
Robert M. Colomb *In its* Detection and Classification of Transients [1964] 4 p refs (See N66-28846 16-07)

An orthonormal function expansion technique useful in biomedical problems where comparison and classification of time-varying functions (such as electrocardiograms, electroencephalograms, or phonocardiograms) is necessary, is described. In such expansions, the signals in question are first compared with a set of reference functions, and then compared with each other in terms of the reference functions. The method used for comparing the two functions is the operation of integrating the product of the two functions over their domain. If the value of this integral is zero, the two functions are normal to each other (as far apart as possible); and if the value is 1, they are parallel to each other (as close together as possible). Three methods (an Intrinsic analysis, a Factor analysis, and a Loeve-Karhunen expansion) recently developed to derive sets of orthonormal functions for particular biomedical signal are discussed. The reference functions of these methods are closely related to the orthonormal technique described, and for purposes of analysis and classification permit comparisons to the technique.
L.S.

N66-28848# Systems Research Labs., Inc., Dayton, Ohio.
A PROBLEM AND A POSSIBLE SOLUTION IN ORTHONORMAL ANALYSIS OF DATA
Robert M. Colomb *In its* Detection and Classification of Transients [1964] 6 p refs (See N66-28846 16-07)

The use of the absolute value of the Fourier transform as the waveform (rather than the time function) in performing filter construction and filtering operations in an orthonormal function analysis for transient type signal data, is detailed. The use of orthonormal analysis techniques for classifying these type of signals depends on the construction of a set of reference functions having the orthonormal property. The function to be analyzed is passed through filters corresponding to each reference function, and a value giving the amount of reference function contained in the analyzed function is obtained. Details

of the mathematical calculations are given. Restrictions on using the absolute value of the Fourier transform for the calculations are discussed. L.S.

N66-28849# Systems Research Labs., Inc., Dayton, Ohio.
METHODS OF DERIVING OPTIMAL ORTHONORMAL FILTER FUNCTIONS
In its Detection and Classification of Transients [1964] 8 p (See N66-28846 16-07)

Two techniques, an orthonormal functional analysis and a Loeve–Karhunen analysis for studying transient type signal data are discussed. A technique of deriving a set of orthonormal functions which are in some sense optimal for a particular class of transients of $\{f_\alpha(t)\}$ if $\{\psi(t)\}$ (a set of reference functions) is an orthonormal base for $\{f_\alpha(t)\}$, is detailed. It is shown that if a particular reference function is taken as the set of eigenfunctions of the autocorrelation function, both of these conditions are minimized. The development of the functions is given. It is noted that the process behaves similarly to a technique for removing the correlation among a set of measurement vectors known as either Intrinsic Analysis or Factor Analysis. The Loeve-Karhunen analysis (for transient-type signal data) gives a set of basis vectors which are eigenvectors corresponding to non-zero eigenvalues of the autocorrelation function. The development of this method is also detailed. It was found that the two techniques produce the same formal answers, and that it is therefore possible to choose between them on such factors as error properties and computation time. In particular, Loeve-Karhunen analysis can be used when more functions are available than sample points. L.S.

N66-28850# Systems Research Labs., Inc., Dayton, Ohio.
DISCUSSION OF A GENERAL METHOD FOR RELATING FREQUENCY, ENERGY (OR AMPLITUDE) AND TIME
In its Detection and Classification of Transients [1964] 5 p refs (See N66-28846 16-07)

A general mathematical method for relating the time distribution of the energy of a transient waveform at given frequencies is discussed. The relationship is expressed by what is termed a score representation. A Gaussian average of the score representation $H_{\alpha\beta}$ (a,b) is used as a measure of the transient signal. It is noted that $H_{\alpha\beta}$ is positive definite for $\alpha\beta > 1/4$. This average can be interpreted as the energy in an area in frequency-time space of length α in the time direction and length β in the frequency direction. This area cannot be smaller than 1/4, so that the energy at a given time and frequency cannot exactly be measured, but only the energy in a certain band for a certain duration. The shape of this minimum area can be freely chosen, and either a narrow band for a long time or a wide band for a short time can be examined. L.S.

N66-29072*# All-Tronics, Inc., Westbury, N. Y.
REPORT OF RADIO INTERFERENCE TEST ON FIFTH DIMENSION, INC. MULTICODER, MODEL NO. HDA4M-839, SERIAL NO. 7243
Harold Herget, Vincent Sheehan, Louis Bozzella, and Frederick J. Sain Dec. 1965 66 p Prepared for Fifth Dimension, Inc. *Its* Rept.-6387E1244
(Contract NAS9-4590)
(NASA-CR-65407) CFSTI: HC $3.00/MF $0.75 CSCL 09F

To determine compliance of the multicoder to radio interference requirements, electromagnetic interference and susceptibility tests were conducted. Basic radio noise and field intensity meters with interchangeable tuning units and pickup devices for the various frequency ranges were used as test equipment. The unit was set up on the ground plane and connected to 28 Vdc through line stabilization networks; it was bonded to the ground plane and was tested in its normal full load mode of operation. The instruments are listed which were used to monitor frame rate, input current, PAM zero and full scale output, PDM zero and full scale pulse width, DPDM output, PAM noise, PDM jitter, and channel presence. Conducted interference, using a line stabilization network and a current probe, and radiated interference were also determined. Results for each test are given, and test data sheets are included. M.G.J.

N66-29179# Navy Underwater Sound Lab., New London, Conn.
ARRAY GAIN FOR THE CASE OF HORIZONTAL NOISE
Benjamin F. Cron, Norbert P. Fisch, and Robert L. Shaffer 11 Apr. 1966 20 p refs
(USL-731; AD-631800) CFSTI: HC $1.00/MF $0.50

Array gain computations based on spatial correlation measurements in the 200–400 cps band and the directionality of the noise field for center frequencies of 112 and 178 cps are obtained. Both sets of measurements indicate more noise from the horizontal direction than from overhead at low frequencies, whereas the opposite is true at the higher frequencies. The results derived from spatial correlation measurements are compared with theoretical values for a directional noise field and vertical receivers, and the influence of sea conditions on the gain is demonstrated. For all element spacings of the 8-element array and all sea conditions considered, the gain varied from a low of 5 db to a high of 12.5 db. For the case of uncorrelated noise, a value of 9 db is obtained for array gain from 10 log N, where N is the number of elements. The results based on directionality of the noise field are below those based on spatial correlation, and the same trend with increasing wind speed is observed. The data for this calculation were available only for the upper half-plane. Author (TAB)

N66-29190# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING COORDINATES OF FAR OFF SATELLITES WITH THE AID OF A TELEVISION SYSTEM [OPYT OPREDELENIYA KOORDINAT DALEKIKH SPUTNIKOV S POMOSHCH'YU TELEVIZIONNOY SISTEMY]
Ye. S. Agapov, V. F. Anisimov et al 23 Mar. 1966 6 p Transl. into ENGLISH of the Russian publ., 1965 3 p
(FTD-TT-65-1679/1+4; AD-631446) CFSTI: HC $1.10/MF $0.50

This article describes the use of a highly sensitive television system on a medium 500 mm meniscow telescope to photograph and determine the coordinates of distant satellites. The television apparatus, with an additional brightness amplifier, is established in kude focus and a 15 ft field of vision. Observation time is recorded by a printing chronograph. Two kinescopes are used, one for tracking and the other for photographing. The satellite coordinates are determined by an interpolation method and by three supporting stars. R.N.A.

N66-29231# Battelle Memorial Inst., Columbus, Ohio. Remote Area Conflict Information Center.
THE DEVELOPMENT OF A MODULAR AUDIO-VISUAL UNIT (MAVU)
Eugene N. Wyler and Carl L. Hanks 20 Apr. 1966 110 p
(Contract ARPA SD-171; Proj. Agile)
(BAT-171-39; AD-631249) CFSTI: HC $12.60/MF $1.00

The development of the Mark II and Mark III Modular Audio-Visual Units is the result of a need for an audio-visual system that would provide the portability required for remote operation by psychological-warfare teams. The major constituents of the MAVU's include a public-address amplifier, radio, tape recorder, and motion-picture projector. A complete description of the Mark II and Mark III MAVU's, including detailed drawings, is presented. Two field evaluations were conducted in Thailand. The first field evaluation tested and proved the concept of the MAVU and its construction from commercial off-the-shelf components. The second field evaluation was a test of prototype production models, the Mark II and Mark III, which incorporated recommendations for improvements that resulted from the first field evaluation.
Author (TAB)

N66-29259# Oslo Univ., Blindern (Norway). Norwegian Inst. of Cosmic Physics.
MEASUREMENTS OF THE EARTH-IONOSPHERIC CAVITY RESONANCE FREQUENCIES AT HIGH LATITUDE Scientific Report No. 4
Alv Egeland and Trygve Roed Larsen 21 Feb. 1966 42 p refs
(Contract AF 61(052)-811)
(AFCRL-66-260; AD-632299) CFSTI: HC $2.00/MF $0.50

The earth-ionospheric cavity resonance frequencies were measured by two methods somewhat different from that employed hitherto by other workers. The instruments used were all battery-operated. The recordings have been carried out close to Isfjord Radio, Spitzbergen (geographic latitude 78 deg 03.9 min N) and close to Lavangsdalen, Northern-Norway (geographic latitude 69 deg 15.5 min N) during 1965. It has been possible to record detailed power spectra of these cavity resonances by integration over only a few seconds of data. Between DC and 45 c/s average peak frequencies at (7.78 ±0.08), (14.05±0.15), (20.3±0.2), (32.1±0.2), (32.1±0.3), (37.1±0.3) and (42.9±0.4) c/s have been observed. Also at frequencies above 45 c/s there seems to be strong indications of higher resonance modes. Author (TAB)

N66-29275# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
LIMITATIONS OF SERIES-FED ARRAYS IN BROADBAND COMMUNICATIONS
Robert B. Crane and C. Bruce Sharpe Apr. 1966 25 p refs
(Contract DA-28-043-AMC-00013(E); Proj. Michigan)
(Rept.-6400-51-T; AD-632012) CFSTI: HC $1.00/MF $0.50

The report covers an investigation of the signal distortion which results when long, series-fed arrays are used for communication. It is shown that under certain conditions the antenna array can be considered as a linear filter, the response of which is a function of frequency as well as of spatial coordinates. The distortion accompanying the transmission as measured by the least mean square difference between the transmitter and the received signal is derived. This expression is evaluated for the case of a uniformly excited array and a rectangular-bandpass signal spectrum. In the absence of noise, the transmitted signal can be completely recovered in the receiver by employment of the proper linear filter. In the presence of noise, the signal cannot, of course, be completely recovered. However, a technique is investigated for minimizing the distortion in this case by use of a prefilter and a postfilter. Author (TAB)

N66-29276# Army Electronics Labs., Fort Monmouth, N. J.
ACTIVE SEISMIC SYSTEMS FOR COMMUNICATIONS AND SURVEILLANCE
Kurt Ikrath, Wilhelm A. Schneider, and Ronald F. Johnson Apr. 1966 99 p refs
(ECOM-2695; AD-632082) CFSTI: HC $3.00/MF $0.75

Experimental and theoretical data are presented on the generation of seismic signals and the efficiency of signal insertion into soil and ice employing 80 cps, 10-Watt max resonant portable seismic transducers. The influence of the mechanical bulk properties and of the structural dimensions of seismic media on the transducer performance and on the preservation of seismic signal integrity is analyzed in connection with seismic communications via the weathered zone of the earth. Author (TAB)

N66-29284# Navy Electronics Lab., San Diego, Calif.
SHIPBOARD INTERFERENCE SIMULATOR
W. M. Chase and T. L. Whalen 12 Jan. 1966 26 p
(NEL-1351; AD-630989) CFSTI: HC $2.00/MF $0.50

A shipboard interference simulator was designed which accurately reproduces the potential frequencies of interference derived from the intermodulation between any combination of simultaneous transmitter fundamental frequencies up to a total of 10. The relationship of interference-signal magnitudes is in reasonable agreement with similar signals actually measured aboard ship. The simulator proved its worth as an aid in demonstrations of intermodulation interference before Naval personnel concerned with shipboard communications problems. The simulator represents an analog computer with which detailed knowledge of intermodulation phenomena can be increased. It is especially valuable when more than the classic two fundamental signals are on together. Author (TAB)

N66-29287*# General Dynamics/Convair, San Diego, Calif.
FM RECEIVER DYNAMIC RESPONSE
G. D. Boyce 25 Jun. 1965 80 p refs
(NASA-CR-72010; GD/C-543-1-65-40) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This report describes a study into the dynamic response produced by an FM receiver employing an amplitude sensitive discriminator. A simple, graphical explanation of the anticipated response is presented. Empirical results obtained in the evaluation of an FM telemetry receiver are included. Analytical techniques leading to a mathematical proof of receiver behavior are discussed. The application of the analog computer to the problem is outlined and the analog simulation of the receiver system described. Computer solutions for a number of conditions are included in the form of graphic recordings. Finally, it is concluded that dynamic response such as that exhibited by the AVCO range safety receiver is the natural behavior anticipated from such a receiver.
Author

N66-29303*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
INSTRUMENTATION FOR CONTINUOUS POLARIMETRY MEASUREMENTS OF SATELLITE TRANSMISSIONS Scientific Report No. 273
Robert J. Sweet 1 Jun. 1966 65 p refs
(Grant NsG-114-61)
(NASA-CR-75849) CFSTI: HC $3.00/MF $0.75 CSCL 17B

The development of a continuous polarimeter applicable to Faraday rotation investigation of satellite transmissions is presented. The system is designed to overcome ambiguities in determination of the Faraday rotation at the ground, under conditions which are likely to produce fluctuations or changes

in the direction of rotation. This is accomplished by resolving the linearly polarized wave into its component oppositely sensed circularly polarized modes using a fixed-geometry antenna system. The component modes are phase compared to determine continuously the position and sense of the plane of polarization of the wave. Author

N66-29330*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF THE TROPOSPHERE AND OF THE IONOSPHERE ON THE TRACKING PERFORMANCE OF SATELLITES [DER EINFLUSS VON TROPOSPHAERE UND IONOSPHAERE AUF DIE ORTUNGSGENAUIGKEIT VON SATELLITEN]

G. Ulbricht Apr. 1964 33 p refs Transl. into ENGLISH of a paper presented at the Ger. Assoc. for Tracking and Navigation Main Meeting on Navigation in the Air and in Space, Berlin, 22–27 Apr. 1963

(NASA-TT-F-8731) CFSTI: HC $2.00/MF $0.50 CSCL 09F

On the basis of published material, a survey of the effect of the troposphere and of the ionosphere on the tracking of satellites has been presented. Both media cause a refraction of the high frequency ray which leads to radio sonde errors, or a retardation of the transmission time which causes distance measuring errors, and to a frequency measuring error in the measurement of the Doppler frequency which leads to an error in position finding. The cause of these effects is the refractive index which varies with the altitude: in the troposphere it is larger than 1 and, within the area considered, independent of the frequency, while in the ionosphere, it is smaller than 1 and dependent on the square of the frequency. The errors are largest in the case of tangential incidence and decrease with the angle of elevation. Author

N66-29341*# National Aeronautics and Space Administration, Washington, D. C.

METHODS FOR ACHIEVING TV SIGNAL DELAY USING ULTRASONIC WAVES [SPOSOBY ZADERZHKI TELEVIZIONNOGO SIGNALA S ISPOL'ZOVANIYEM UL'TRAZVUKA]

I. V. Zakharov May 1964 15 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 8, 1963 p 29–35

(NASA-TT-F-8885) CFSTI: HC $1.00/MF $0.50 CSCL 20N

Long and short-term delay of television transmission signals by using ultrasonic waves is assessed. Electric delay lines are successfully used to delay TV signals for short time intervals (a part of one line). For long time interval delays, the following methods are used: (1) magnetic recording and subsequent reproduction, (2) electron storage tubes, and (3) ultrasonic delay lines. The effects of magnetostrictive transducers, and liquid, monolithic, tape, cylinder and wire delay lines on ultrasonic wave propagation are discussed, as are temperature stabilization, control of delay time, and signal-to-noise ratio. It is concluded that ultrasonic delay lines make it possible to store television signals for a period of time from one line or less to half a frame and more, and that of the piezoelectric lines, those with ceramic shear transducers have the lowest attenuation. R.Ll.

N66-29342*# Research Triangle Inst., Durham, N. C. Radiation Systems Lab.

ANALYTICAL STUDY TO DEFINE AN EXPERIMENTAL PROGRAM FOR THE EVALUATION AND OPTIMIZATION OF MULTI-ELEMENT LARGE APERTURE ARRAYS Interim Report

Jun. 1964 232 p refs *Its* RTI Program RU-170

(Contract NAS1-3780)

(NASA-CR-60415) CFSTI: HC $6.00/MF $1.25 CSCL 09F

Analytical studies were conducted to evaluate basic limitations and capabilities of large-aperture antenna arrays. The need for an extensive experimental program is emphasized because of the high costs of building operational arrays and design errors resulting from incomplete background data. The array parameters discussed include: antenna characteristics, sources of phase instabilities, intra-array phase compensation, angle acquisition and tracking methods, signal summation, and phase acquisition and tracking. To obtain data for evaluating operational problems, an optimum experimental program is described for a two-antenna system and a prototype system. The overall electronic system associated with each antenna in the array is described, and major subsystems are briefly discussed. Examples of available equipment are given to serve as guidelines in planning the complete experimental system. S.P.

N66-29369*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

EFFECTS OF THE PLASMA SHEATH ON ANTENNA PERFORMANCE

C. T. Swift and H. Hodara (Natl. Eng. Sci. Co., Pasadena, Calif.) Washington, NASA [1965] 45 p refs Presented at the AGARD/IRC Meeting on Radio Wave Propagation Factors in Space Commun., Rome, 21–25 Sep. 1965 Prepared jointly with Natl. Sci. Eng. Co.

(Contract NAS1-4623)

(NASA-TM-X-56860) CFSTI: HC $2.00/MF $0.50 CSCL 09F

Mathematical techniques were developed by which antenna radiation patterns and near field effects can be evaluated by solving aperture and plasma problems independently. As a special application of these techniques, infinitely long slots on planes and cylinders, coated with a typical reentry plasma profile were analyzed. Radiation patterns of the coated slotted plane and coated slotted cylinder; and admittance plots for the coated slots are depicted. Results indicate that if the collision frequency is low, the peak value of the plasma frequency determines the radiating characteristics of the aperture. At the critical point, both the patterns and admittance undergo drastic changes. A homogeneous plasma equivalent of the inhomogeneous plasma coating discussed above gives only general trends of pattern behavior. It was noted that the external admittance of the particular slotted planes and cylinders considered differed by only a few percent. Tables are also given, whereby the external admittance of a finite aperture on a plane coated with the inhomogeneous plasma can be computed by using the table values with a double integral expression (given in the calculations). L.S.

N66-29371*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

RADIATION PATTERNS AND ADMITTANCE OF AN AXIAL SLOT ON A PLASMA COVERED CYLINDER

C. T. Swift, C. M. Knop, and H. Hodara (Natl. Eng. Sci. Co., Pasadena, Calif.) [1965] 76 p refs Presented at the 3d Symp. on the Plasma Sheath Plasma Electromagnetics of Hypersonic Flight, Boston, 21–23 Sep. 1965 Prepared jointly with Natl. Eng. Sci. Co.

(Contract NAS1-4623)

(NASA-TM-X-56814) CFSTI: HC $3.00/MF $0.75 CSCL 09F

Theoretical calculations for describing the admittance characteristics of three types of coated slotted-cylinder antennas, (long axial slot, finite axial slot, and gap antenna backed

by a short-circuited radial cavity) are presented. Most of the effort here concerns a study of the long slot on the cylinder. Systematic computations of the admittance per unit length were made for various coating conditions. First the case of no coating is considered, and results are compared with those for identical slots on flat ground planes. Second, the special case of the plasma resonant coating was analyzed to determine whether or not a measurement of the input admittance at resonance yields diagnostic information. Finally, the case of a general coating is treated to ascertain the effects of losses and plasma inhomogeneities on the admittance. Experimental results for both coated and uncoated cylinders are compared to theory. Admittance expressions for the coated cylinder are given, and preliminary calculations of the conductance are discussed. Experimental and theoretical results for radiation patterns; and the gap antenna are also discussed. Several tables of impedance data, schematic diagrams of the cylinder geometry, admittance curves, radiation pattern graphs, and photographs of the equipment are included. L.S.

N66-29377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE APOLLO UNIFIED S-BAND SYSTEM

William P. Varson [1964] 22 p Presented at the Instr. Soc. of Am. Conf. and Exhibit, Cocoa Beach, Fla., 27–28 Oct. 1965 (NASA-TM-X-56897) CFSTI: HC $1.00/MF $0.50 CSCL 09F

The incorporation of the Unified S-Band System into the Apollo Manned Space Flight Network is described. The existing network instrumentation is capable of supporting the earth-orbital phases of the mission. The Unified S-Band System will be the only means of tracking and communicating with the Apollo spacecraft during the lunar phases of the mission. The System uses a single carrier frequency in each direction. The S-Band approach was adopted rather than extending the range of the existing network equipment because it offered a superior technical solution with a minimum of new developments (such as high-powered radar beacons to expand the range of the existing equipment e.g.). Systems capable of operating to lunar distance which use the unified systems techniques were already in operation. The deep space facilities which use 85-ft antennas spaced at equal intervals of longitude around the earth to provide continuous lunar mission coverage, the stations which use 30-ft antennas, and shipboard facilities are discussed. Other features of the Unified S-Band System are also described; and charts depicting the modulation technique, and the frequency spectrum of the System are included. L.S.

N66-29381*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

OPTIMUM LINEAR FILTERING OF AN INTEGRATED SIGNAL IN WHITE NOISE

Donald L. Snyder [1965] 5 p refs Submitted for Publication (Grants NsG-334; NsG-496; Contract DA-36-039-AMC-3200(E); Grant NSF GP-2495) (NASA-CR-67853) CFSTI: HC $1.00/MF $0.50 CSCL 09D

Calculations for solving the problem of an analog message a(t) passed through an ideal integrator to produce a signal b(t) which is observed in additive white noise n(t) are presented. The observed signal r(t) is defined by: $r(t) = b(t) + n(t) = \int_{-\infty}^{t} a(u)\,du + n(t)$ over the interval $(-\infty, t)$. Given the observed signal, a linear, minimum-mean-square-error estimate of the message a(t) can be obtained. Beginning with the solution to the Wiener-Hopf equation, it is demonstrated that the optimum linear filter for estimating a(t) without delay is given by:

$$H_{opt}(\omega) = j\omega\sqrt{N_0}\left[\frac{1 - j\omega + f(0)}{(S_a(\omega^2) + \omega^2 N_0)^+}\right]$$

and the minimum-meansquare error, ϵ^2_{min}, in estimating a(t) without delay is:

$$\epsilon^2_{min} = \frac{N_0}{3} f^3(0) + F(0)$$

The mathematical expressions for f(0) and F(0) are given. L.S.

N66-29393*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE LUNAR ORBITER TELECOMMUNICATIONS SYSTEM

W. T. Bundick, C. H. Green, and E. A. Brummer [1965] 23 p refs Presented at the 1965 Intern. Space Electron. Symp., Miami Beach, Fla., 2–4 Nov. 1965 (NASA-TM-X-56768) CFSTI: HC $1.00/MF $0.50 CSCL 09F

This paper describes the design of both the spacecraft and ground equipment of the Lunar Orbiter Telecommunications System. Some of the unique features of the design include the use of vestigial sideband modulation for transmission of the picture data, a full-verification command system, a low-gain antenna system, whose pattern approaches that of an isotropic radiator over a large portion of the radiation sphere, and a dual-power-level transmission system which does not use RF switching. Included in the paper is a link-design chart which shows the S/N ratios and performance margins obtained for all operating modes. Author

N66-29397*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A PHASED ARRAY ANTENNA SYSTEM FOR COMMUNICATION SATELLITES

William Korvin and George G. Chadwick (Radiation Systems, Inc.) [1965] 53 p refs Submitted for Publication (NASA-TM-X-56896) CFSTI: HC $3.00/MF $0.50 CSCL 09F

Antenna pattern coverage requirements for communication satellites under various altitude and attitude conditions are reviewed, and characteristics of some practical antenna designs are considered. The theories of cylindrical array and 12-element planar array systems are analyzed, and their geometries are discussed. Based on these data, an engineering model of a multibeam, high gain, 4π steradians coverage antenna system was developed and tested to demonstrate the feasibility of the theory. Block diagrams and measured characteristics are given to explain its operation. It was concluded that the model most nearly satisfies the following requirements for a multipurpose antenna system: high gain and some discrimination against electrical interference, circular polarization, frequency bandwidth of 15% to 25%, ability to receive or transmit in multiple directions either simultaneously or with nanosecond switching time over 4π steradians of space, kilowatt peak power handling capacity, compact size, low drive power for phasing devices, and radiating elements that conform to the diameter of the satellite. L.E.W.

N66-29407*# National Aeronautics and Space Administration, Washington, D. C.

PRECISION MEASUREMENT OF LUNAR AND SOLAR RADIO EMISSION IN THE 4-MILLIMETER BAND [PRETSIZIONNOYE IZMEREniYE RADIOIZLUCHENIYA LUNY I SOLNTSA V 4-X MILLIMETROVOM DIPAZONE VOLN]

A. G. Kislyakov and V. M. Plechkov May 1964 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 7, no. 1, 1964 p 46–50

(NASA-TT-F-8874) CFSTI: HC $1.00/MF $0.50 CSCL 17B

The emission of the sun and the moon was compared with that of a black disk of known angular dimensions. It was found that at a wavelength of 4 mm the brightness temperature of the sun is equal to 7,300° K±200° K, while at the same wavelength the phase dependence of the radio emission of the moon is well described by the law $\bar{T}_e=[204+56\cos(\Phi-23^\circ)]^\circ$ K, where $\bar{T}_e$ is the mean brightness temperature of the lunar disc; and Φ is the lunar phase reckoned from full moon. The accuracy of the measurements of the absolute value of $\bar{T}_e$ was not less than 4%. The results of the measurements were used to estimate the radio emissivity of the lunar soil and to calculate the phase dependence of the radio emission of the center of the lunar disk. Author

N66-29449*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESEARCH APPROACHES TO THE PROBLEM OF REENTRY COMMUNICATIONS BLACKOUT

Paul W. Huber and Theo Sims [1965] 33 p refs Presented at the 3d Symp. on the Plasma Sheath, Boston, 21–23 Sep. 1965 Sponsored by AFCRL

(NASA-TM-X-56839) CFSTI: HC $2.00/MF $0.50 CSCL 20N

To significantly reduce the constraints on radio-link systems due to reentry blackout, it is necessary to define accurately the extent of the blackout region and develop methods for reducing its extent. Research efforts of fundamental plasma processes and em-wave propagation are described. It is shown that certain aspects of the problem are accessible to simulation in ground facilities and that small-scale flight experiments and piggyback experiments can be useful for supplementing knowledge in those areas not obtainable on the ground. Generalized blunt-body reentry blackout bounds, as based on state-of-the-art knowledge, are presented. It is shown that reentry blackout extent for a given body can be minimized through the choice of signal frequency and antenna location. Factors influencing antenna location include the configuration and type of separated plasma fluid, as well as the nonequilibrium nature of the inviscid and boundary-layer flow. Author

N66-29485*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.

MILLIMETER COMMUNICATION PROPAGANDA PROGRAM Second Quarterly Report, 1 Feb.–1 May 1965

[1965] 211 p refs

(Contract NAS5-9523)

(NASA-CR-67320; FR-65-186; K-625-65-2) CFSTI: HC $6.00/MF $1.25 CSCL 17B

Progress is reported on a program being conducted to design experiments to determine the effects of the propagating medium on millimeter wave space–earth communications. This report discusses ground facilities equipment configurations, synchronous satellite orbital analysis, signal processing, data processing, and design of ground and spacecraft equipment. The equipment design is an expansion of previously reported general design data and can be applied to experiments using medium altitude satellites as well as synchronous altitude satellites. Most of the signal and data processing information can be applied to both types of satellites. Schedule and budgetary costs are presented for a total flight hardware and ground facility hardware program. The recommended experiment design can be conveniently broken down into segments and experimental links, certain combinations of which can be chosen for implementation depending on the limitation of financial resources, urgency for the scientific information, and payload allocations aboard available satellites. R.N.A.

N66-29511*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FILTERING TECHNIQUES FOR NOISE SUPPRESSION IN QUASI-BALANCED CIRCUITS

W. R. Johnson 15 Jun. 1966 25 p

(Contract NAS7-100)

(NASA-CR-75930; JPL-TR-32-945) CFSTI: HC $1.00/MF $0.50 CSCL 09D

This report describes common-mode noise voltages, which may be present in electrical power and signal circuits, and submits means of preventing such noise from interfering with electronic equipment through the proper selection of filters and/or electrostatically shielded isolation transformers. As will be shown, there is a distribution of solutions to the problem. However, if the problem is generally understood, a solution may be proposed on the basis of the information in this report. An attempt has been made to define test methods for determining the type of mode present in a circuit. General application of filters and isolation transformers to balanced-mode and common-mode noise voltage problems appears in tabular form. The grounding philosophy for multishielded transformers is not considered here. Author

N66-29526# Weapons Research Establishment, Salisbury (Australia).

THRESHOLD EFFECTS IN FM DATA SYSTEMS

M. J. Malone Apr. 1966 22 p refs

(ISD-69) CFSTI: HC $1.00/MF $0.50

The threshold noise performance of a limiter–discriminator, with input signal uniformly distributed over the full scale frequency deviation range, is analyzed in terms of an evaluation criterion which specifies the system resolution (±R) and the probability (P) with which output noise exceeds that resolution. This criterion, meaningful above and below threshold, forms a basis for a precise definition of threshold, the location of which is determined equally precisely and found to lie between 6 dB and 10 dB input signal to noise ratio for the range of (R,P) values considered. The channel efficiency of FM relative to Shannon's law is also determined approximately in the light of this criterion, from which the ultimate FM threshold follows. Author

N66-29560# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.

WAVEGUIDE GLIDE SLOPE ANTENNA TESTS Final Report

A. D. Mehall Apr. 1966 109 p

(Contract FA-64WA-5058)

(RD-66-29)

This report describes development and operation of a multireference feed system for the directional waveguide glide-slope antenna and the results of pattern measurements performed in the antenna near field. The operation of an aperture-field monitor for the waveguide array is also described. Author

N66-29561# Joint Publications Research Service, Washington, D. C.
THE RELIABILITY OF COMMUNICATIONS EQUIPMENT FROM AN ECONOMIC VIEWPOINT
H. Weiher 21 Jun. 1966 18 p refs Transl. into ENGLISH from Nachrichtentechnik (E. Berlin), v. 16, no. 2, Feb. 1966 p 46-49
(JPRS-36120; TT-66-32554) CFSTI: $1.00

Investigation of the requirements to be met by electronic equipment and installations indicated that reliability and economy in industrial and commercial electronics will be the decisive criteria for evaluating future installations. Mutual relations between reliability and economy in the German Democratic Republic were studied to ensure maximum reliability for optimum economy. Fundamental economic viewpoints were derived for reliability calculations from mathematical formulas. It was pointed out that increase in reliability corresponds to decrease in failure frequency and decrease in failure time. The annual costs are considered as a measure for reliability evaluation and are treated as a function of initial costs, maintenance costs, apparatus lifetime, and optimum average failure rate. L.E.W.

N66-29568*# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
OBSERVATIONS OF MARINER IV WITH THE PARKES 210-FT RADIO TELESCOPE
D. J. Cole and P. R. Crosthwaite Feb. 1966 22 p
(Grant NsG-240-62)
(NASA-CR-75890; RPL-173) CFSTI: HC $1.00/MF $0.50
CSCL 09F

The performance of the Parkes 210-ft radio telescope for the reception of data from distant spacecraft has been demonstrated by observations on Mariner IV in the vicinity of Mars. Signal levels and frequencies received from the spacecraft were observed during a two-month period, and telemetry recordings were made during the picture transmission period following the Mars encounter. An attempt was made to observe the occultation exit which occurred below the normal horizon of the telescope. This report briefly describes the equipment used and the results obtained. Author

N66-29630*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COMMUNICATIONS AND INSTRUMENTATION
Clifford M. Jackson, Andrew Hoboken (Mc Donnell Aircraft Corp.), John W. Goad, Jr., and Meredith W. Hamilton *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 39-45 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Descriptions and performance results are presented for the Gemini communications and instrumentation system which consists of subsystems for voice communications and tracking, digital command, recovery aid, and data acquisition and transmission. Primary voice communications system for the Gemini spacecraft is of very high frequency, with an antenna consisting of quarter-wave monopoles mounted to provide satisfactory radiation patterns for each mission phase. A high frequency voice transmitter-receiver provides an emergency link when the landing position of the spacecraft is unknown. The digital command system consists of a dual-receiver single-decoder unit and two relay packages, and the ground stations are programmed to repeat each message until an acceptance pulse is received. The instrumentation systems used on the various Gemini spacecraft are described; and details are presented for the standard pulse code modulation equipment on Gemini II to Gemini VII. Problem areas and flight failures of instrumentation components are discussed. M.W.R.

N66-29698# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOELECTRIC TRACKING DEVICE
G. P. Katys and Yu. V. Strel'nikov 29 Apr. 1966 7 p Transl. into ENGLISH from Soviet Patent no. 160777 (Appl. no. 818157/26-30, 26 Feb. 1964) 3 p
(FTD-HT-66-81/1+4; AD-632309) CFSTI: HC $1.00/MF $0.50

The purpose of the invention is a photoelectric tracking device which utilizes a dissector as the sensitive element. At the photocathode of the dissector a point image of the tracking object is projected and a signal from its output is compared in phase with a reference signal. A circular diaphragm is mounted before the anode of the dissector concentric with the axis of the optical system and dissector, and two pairs of deflection coils in the transfer section of the dissector are connected to a stabilized AC source which provides restrictively to each pair of coils sinusoidal voltages of the same frequency and displaced in phase from one another by 90° TAB

N66-29733*# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
EFFECTS OF SURFACE RANDOMNESS OF RADAR BACK-SCATTER FROM A SPHERICAL SURFACE
Donald H. Lenhert and Ahmed Erteza [1966] 175 p refs
(Grant NsG-129-61)
(NASA-CR-76016; EE-132) CFSTI: HC $5.00/MF $1.00
CSCL 09F

A vector solution for the scattering of electromagnetic waves from distant rough surfaces was investigated. Integral expressions of the direct- and cross-polarized instantaneous back-scattered power from an arbitrary homogeneous rough sphere were formulated. An approximate solution was obtained for the time-averaged expected values of direct- and cross-polarized received power from a normally distributed surface for the condition that the ratio of standard deviation to correlation distance is much less than one over the square root of the radius of the sphere in wavelengths. Comparison of this solution with experimental data indicates that the moon must have a roughness characterized by a much larger value of this ratio. A rigorous field theory of the pulsed return from a slightly irregular sphere was formulated. The amplitude of the cross-polarized return was found to be a function of both electromagnetic and surface roughness properties. It was felt that this analysis does not give sufficient information for estimating the properties of the lunar surface, but may be useful in solving other cases yielding better estimates. N.E.N.

N66-29791# ITT Federal Labs., Nutley, N. J.
DATA BUFFERING TECHNIQUES STUDY Second Quarterly Report, 1 Jan.-31 Mar. 1966
[1966] 21 p refs
(Contract DA-28-043-01471(S))
(Rept.-5; AD-631497) CFSTI: HC $1.00/MF $0.50

The purpose is the performance of a study of techniques and equipment for the accomplishment of data buffering to correct data flow for varying range and range rates of satellite repeaters. The program is divided into four phases: investigation and selection phase, design and fabrication

phase, test and performance phase, and engineering design phase. A design was evolved for a controlled data buffering system breadboard capable of correcting data flow for varying range and range rates of satellite repeaters. Based on the design layouts, block diagrams, logic diagrams and printed circuit artwork were made, and components ordered. Fabrication of the breadboard is in process. A four-stage test plan has been developed. TAB

N66-29798# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE STATISTICAL INFERENCE OF PARAMETERS FROM SATELLITE TRACKING DATA
William H. Guier Jan. 1964 202 p refs
(Contract NOw-62-0604-c)
(TG-548; AD-631804) CFSTI: HC $5.00/MF $1.00

A method for statistically inferring the values of time dependent parameters from doppler data for what is believed to be the simplest case that is still realistic, is presented. This method includes errors with correlation times longer than the satellite pass time, and the equations are reduced to a form that may be adapted for use in digital computers. The principles of the method are discussed in detail. A linear expansion of the doppler residuals is made in the time dependent parameters, which are approximated by constants for the tracking interval considered. Additionally considered is the character of the errors in open loop doppler data, including errors that are correlated for times longer than a satellite pass time. Added to this theory is a method for estimating the values of the tracking station local oscillator frequencies. This theory includes the station's estimate of its local oscillator frequency and the probable error in this estimate. The method is developed; the assumptions made are discussed; and a mathematical analysis of the theory is included.
H.S.W.

N66-29807# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
WAVEGUIDE ADMITTANCE FOR RADIATION INTO PLASMA LAYERS—THEORY AND EXPERIMENT Scientific Report No. 8
Janis Galejs and Michael H. Mentzoni Apr. 1965 26 p refs
(Contract AF 19(628)-2410)
(RR-451; S-3040-8; AFCRL-65-373; AD-618398) CFSTI: HC $2.00/MF $0.50

Measured admittance of an X-band waveguide radiating into dielectric and plasma layers is compared with variationally computed admittance figures. The waveguide admittance measurements for polystyrene sheets of varying thicknesses compared closely with calculations. The admittance measurements for plasma layers are made during the diffusion controlled afterglow of a pulsed discharge contained in a bell-shaped vessel. The plasma density was measured over approximately 70 percent of the thickness of the plasma layers and was found to be nearly constant in this range which excluded regions near the boundary. Numerical solutions of the equations for ambipolar diffusion during the afterglow in a rectangular geometry show that the lateral plasma density variations are negligible in the vicinity of the waveguide. The measured admittance and plasma density data are shown to agree with calculations made for homogeneous plasma layers, if a correction is made for elevated ion temperatures for times of approximately 10 to 20 microsec. following the discharge. Several computational models consider plasma stratifications near the boundary of the plasma layer but they do not improve the agreement between measurement and calculations.
TAB

N66-29820# New England Univ., Armidale (Australia).
RADIO WAVE INTERACTION USING GYRO-WAVES Final Report, 1 Jul. 1960–Jul. 1965
Reginald A. Smith, Ian A. Bourne, Robert G. Loch, C. B. Gopala K. Setty, Timothy N. R. Coyne et al 17 Jun. 1965 286 p refs *Its* Sci. Rept.-3
(Contract AF 19(604)-6177)
(AFCRL-65-460; AD-627052) CFSTI: HC $6.00/MF $1.50

Wave interaction produced in the lower night-time E region by extraordinary gyro-waves was studied for powers up to 500 kW into a circularly polarized array of 40 dipoles. Accurate values of the energy loss coefficient, the electron relaxation time and the electron collision frequency at heights of 85 km in the mesopause and 69 km in the D region were obtained. The electron density profile at the base of the night-time E region was deduced from the variation of the time constant of impressed modulation with frequency of the disturbing wave and is found to be stratified when the analysis is made using the Sen and Wyller M. I. theory. Wave interaction records for the daytime D region were obtained with continuous variation of the transmission time of the disturbing pulse from well ahead of the wanted pulse to just before the return of the wanted echo. Phase-height patterns of partial reflections from the D region were observed, on occasions, to exhibit a remarkable degree of phase coherence. Magneto-ionic formulae for the propagation of gyrowaves and accurate new Q. L. formulae with wide application under non-deviating conditions are given without derivation. TAB

N66-29861# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: PRINT PROGRAM
John D. Drinan 9 Mar. 1966 99 p refs *Its* Tech. Note 1966-11
(Contract AF 19(628)-5167)
(ESD-TR-66-155; AD-632339) CFSTI: HC $3.00/MF $0.75

During the operation of the Haystack pointing system, variable amounts of system generated data are recorded on magnetic tape for purposes of later reconstruction of the pointing aspect of the experiment. The print program, a pseudo-celestial computation program, is the means whereby this system data, recorded during actual system operation or during a system planning run, is reconstituted in the form of print-outs for immediate inspection or as BCD magnetic tape equivalents of the print-outs for remote printing and for input to other programs. The print program provides a variety of operation options which can be altered dynamically.
Author (TAB)

N66-29863# Navy Underwater Sound Lab., New London, Conn.
GAIN OF A THREE-DIMENSIONAL ARRAY IN A DIRECTIONAL NOISE FIELD
Benajmin J. Cron and Clair J. Becker 13 Apr. 1966 40 p refs
(USL-710; AD-632359) CFSTI: HC $3.60/MF $0.50

The array gain of a three-dimensional 32-element array is obtained for the case of directional noise. For a perfectly coherent signal, the array is given in terms of the spatial correlation of noise. A brief review of the spatial correlation equation corresponding to directional noise is given. Experimental verification of this model is cited. The array gains are compared for the isotropic and directional noise cases for ±13° steering from the horizontal direction. The ±degree beam for the isotropic noise case is close to the +13° beam of the directional noise case but is very different from the −13° beam of the directional noise case. The maximum difference being about 10 dB. The maximum gain for the latter case is 27 dB.
Author (TAB)

N66-29868*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION FROM A SLOT ANTENNA IN A GROUND PLANE COVERED BY A WARM PLASMA LAYER
Norman C. Wenger Washington, NASA, Jul. 1966 38 p refs (NASA-TN-D-3504) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The electromagnetic properties of a model of a reentry plasma layer are determined by using the linearized hydrodynamic equations for a single fluid warm plasma medium. The model consists of a perfectly conducting plane of infinite extent covered by a warm plasma layer of uniform density. The field excited by a slot antenna in the conducting plane is computed by using Fourier transform techniques. Expressions are obtained for the radiation field and for the waves guided along the plasma layer. Numerical results are presented that show the dependence of the energy transport by the field on frequency and electron temperature. In addition, the radiation pattern of the far-zone field is computed for various frequencies and electron temperatures. Author

N66-29883# ITT Federal Labs., Nutley, N. J.
DIRECTIONAL GLIDE-SLOPE ANTENNA SYSTEM Interim Report
R. Heinick, G. Lehman, and F. W. Iden Sep. 1965 53 p ref (Contract FA-WA-4465)
(RD-65-11; PB-169196)

This report covers the field testing program for a directional glide slope antenna system. These tests were conducted at the following operational airports with problem site conditions: Kanawha County Airport, Charleston, West Virginia, and Greater Pittsburgh Airport, Corropolis, Pennsylvania. Included in this report are typical flight recordings as well as the glide slope characteristic curves resulting from the in-flight data. The analysis of this data establishes satisfactory Category I operation at both sites with probable Category II operation at the Charleston, West Virginia site. Author

N66-29886# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
ON THE NATURE AND OPTIMIZATION OF THE GROUND (LATERAL) WAVE EXCITED BY SUBMERGED ANTENNAS
D. Staiman and T. Tamir Jan. 1966 53 p refs (Contract AF 49(638)-1402)
(PIBMRI-1292-65; AD-632378) CFSTI: HC $3.00/MF $0.50

The radiation of a dipole immersed in a conducting dielectric half-space bounded by air is examined by employing a representation which resolves the field into a space wave, a lateral wave and lower order diffraction terms. At points away from the interface between the two media, the far field is given primarily by the space wave which appears as a geometric optical ray contribution. However, at points close to the air-dielectric boundary, the field (known then as a 'ground wave') is dominated by the lateral wave whose quasi-optical properties are discussed in detail. It is shown that the ground wave may be enhanced by orienting the dipole in a direction which optimizes the excitation of the lateral wave. The optimum condition is obtained as a function of the properties of the lossy medium and it is shown that, for small condutive losses, the ground wave is strongest when the free-space radiation of the dipole is directed at an angle close to the critical angle of reflection in geometrical optics. For large losses, the optimum orientation is realized when the dipole is nearly parallel to the interface, in agreement with previous results. Quantitative results are presented for the fields produced under these optimum conditions; calculations are given over wide frequency ranges with specific results for representative cases of grounds consisting of dry earth, moist earth or sea water. Author (TAB)

N66-29920# Michigan Univ., Ann Arbor. Radiation Lab.
THEORETICAL AND EXPERIMENTAL STUDY OF THE SCATTERING BEHAVIOR OF A CIRCUMFERENTIALLY-LOADED SPHERE Scientific Report No. 6
Valdis V. Liepa and Thomas B. A. Senior Feb. 1966 123 p refs *Its* Rept.-5548-6-T
(Contract AF 19(628)-2374)
(AFCRL-66-124; AD-631998) CFSTI: HC $4.00/MF $0.75

The electromagnetic scattering behavior of a metallic sphere loaded with a circumferential slot in a plane perpendicular to the direction of incidence is investigated. The slot is assumed of small but finite width with a constant electric field across it, and under this assumption, the analysis of external fields is exact. The scattered field is obtained by superposition of the field diffracted by an unloaded sphere and that radiated from the excited slot, with the radiation strength and phase determined by the loading parameters. Thus the scattering behavior is determined by the loading admittance and the position of this slot. The numerical study is restricted to the frequency range corresponding to $0<ka<10.0$, and the results presented are primarily for passive loading. The maximum and minimum back scattering cross sections and the loading needed to attain these are presented for different loading positions. The bistatic scattering patterns are computed for a sphere loaded for zero back scattering and from these the back scattering null widths are obtained. The extreme total scattering cross sections are evaluated using the forward scattering theorem and, for small values of ka, the result is compared with that obtained by direct integration of the differential cross sections. Experimental data, obtained using a metallic sphere with an equatorial slot backed by a radial cavity of adjustable depth, is presented for the surface field and back scattering measurements. The results are compared with the computed data. Author (TAB)

N66-29931# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SATELLITE RADIO COMMUNICATIONS
Stefana Darackiego 17 Feb. 1966 281 p refs Transl. into ENGLISH of the book "Radiokomunikacja Satelitarna" Warsaw, Wydawnictwa Komunikacti i Lacznosci, 1966 p 1-159 (FTD-TT-65-109/1+2+3+4; AD-632243) CFSTI: HC $8.00/MF $1.25

This publication on telecommunications problems presents the problems of satellite radiocommunications as seen by Polish experts, working in areas which cover or concern problems of the same type, but which are differently applied. Problems connected with the rapid rise in the demand for intercontinental telecommunication channels are presented. It is proposed that the planned undersea cable lines will not be able to ensure a sufficient number of channels, thus making it necessary to look for other solutions to this problem. A general view of the proposed and planned means of achieving a technical solution for satellite links is presented. The problem of radiowave propagation is discussed in connection with the construction of satellite and ground station antennas. Selected problems on microwave transmission and reception engineering are presented. A review is made of the most important problems connected with the launching of satellites into orbit and with the stabilization of their motion.

Finally, future experiments on communication facilities for Poland are described. Author (TAB)

N66-29949# Rome Air Development Center, Griffiss AFB, N. Y.

INVESTIGATION OF SCATTERING PROPERTIES OF A LARGE ARRAY OF INDEPENDENT ACTIVE X-BAND ELEMENTS Final Report

Dean L. Baerwald and Anthony F. Snyder Apr. 1966 52 p refs (RADC-TR-65-540; AD-632295) CFSTI: HC $2.00/MF $0.75

This report describes the predicted and measured characteristics of an 81-element X-band array of integrated spiral antenna-tunnel diode amplifier units. Monostatic scattering patterns are given for in-phase elements and for progressively shifted rows of elements. Theoretical scattering pattern functions are derived for arrays of independent scattering elements. Array radar cross section is compared to a flat conducting plate of similar dimensions. Element and array bandwidth are determined and compared. Author (TAB)

N66-29960# Sichak Associates, Nutley, N. J.

COHERENT FOCUSING RADAR (COFFER) Final Report

Griffiss AFB, N. Y., RADC, Apr. 1966 63 p refs (Contract AF 30(607)-3492)

(RADC-TR-65-517; AD-632218) CFSTI: HC $3.00/MF $0.75

An Echo II tracking experiment was attempted using the coherent focusing radar (COFFER) system developed under contract AF 30(602)-2750. The objective was to investigate acquisition time, coherency of focus and tracking capability of the equipment when used with a satellite target. The COFFER equipment was previously optimized for aircraft targets and depended on externally supplied look angles from another radar for target acquisition. For use with Echo II, the system was modified somewhat and an optical tracking subsystem was added for aid in acquisition. However this method of acquisition was effective only during visual passes of the satellite in good weather which did not prevail during the time available. Only limited results were obtained for this reason. Author (TAB)

N66-29976*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

THE PRINCIPLE AND DESIGN OF A VERNIER FM RADAR SYSTEM

Tsutomu Suzuki 31 May 1966 33 p refs *Its* Rept.-1388-21 (Grant NsG-213-61)

(NASA-CR-76086) CFSTI: HC $2.00/MF $0.50 CSCL 09F

This paper describes the principle and the signal design of a proposed new FM radar system. In order to measure the surface characteristics of a small target at a long distance, or to discriminate among multiple-targets, very accurate range or doppler resolutions are necessary. The proposed system satisfies the range resolution requirement by detecting the target with two different resolutions: coarse resolution for measuring range, and fine resolution for measuring the target details. The principal advantage of the system is in the Vernier scale for the measurement of a distance. The system is just as easily realizable as conventional FM radar, requires no special filters in the receiver, and represents a saving in the required bandwidth for the same range resolution. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-28430# Joint Publications Research Service, Washington, D. C.

THE INFORMATION APPROACH TO FINDING THE EXTREMUM OF FUNCTIONS

Yu. I. Neumark and R. G. Strongin *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 20-34 refs (See N66-28428 16-10) CFSTI: $6.00

The results of search for the minimum of functions based on the principle of maximum information are discussed. The results are presented from a search for the minimum of some functions with one and with several minima, and the search for a minimum in the presence of noise. Author

N66-28473# Wyle Labs., Inc., Huntsville, Ala.

UTILIZATION OF A DIGITAL COMPUTER FOR ON-LINE ACQUISITION AND ANALYSIS OF ACOUSTIC AND VIBRATION DATA

Daniel J. Bozich *In* NRL The Shock and Vibration Bull. Feb. 1966 p 151-180 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

An analog/digital data system was developed to acquire either random or sinusoidal sweep test data from a large number of data channels within the real time duration of the test, and to store these data on digital magnetic tape for later analysis and reduction. Techniques were also developed and programmed in conjunction with this system, for acquiring and analyzing random data or sinusoidal sweep data. The unique technique developed for the acquisition and analysis of sinusoidal sweep (or step) data preserves the response amplitude and relative phase angle characteristics of each channel in a way such that a variety of interchannel relationships can be established accurately. Input and transfer functions throughout the force generating system and the vehicle structural system can be obtained easily and interrelated, even though the data are taken at different times. Examples of input force amplitudes vs frequency, and force-to-acceleration transfer function amplitude vs frequency are included. Author

N66-28474# McDonnell Aircraft Corp., St. Louis, Mo.

A DIGITAL DATA RECORDING SYSTEM FOR STRUCTURAL DYNAMICS RESPONSE TESTING

M. H. Hieken *In* NRL The Shock and Vibration Bull. Feb. 1966 p 181-191 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

Data generated in the course of structural dynamics response tests is characterized by a broad frequency range and a wide dynamic range. A digital data recording system has been developed which overcomes the frequency and range problems and permits automated recording and reduction of frequency response data. The essential elements of the system are a wide dynamic range, a high linearity full wave rectifier, and a detector which performs a true integration of the rectified signals. These components are coupled with a scanner to sequentially sample a number of channels and an incremental magnetic tape recorder to store the data in a form suitable for

processing by digital computers. In addition to a complete description of the data system, a discussion of the errors in the system is provided Author

N66-28475# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
COMPARISON OF ANALOG AND DIGITAL METHODS FOR VIBRATION ANALYSIS
William K. Shilling, III *In* NRL The Shock and Vibration Bull. Feb. 1966 p 193–208 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

Analog analyzers are compared with theoretical results and digital computer analyses, and the results are reported. These comparisons provide a method for determining the accuracy of analysis and establish advantages or limitations of analog and digital procedures for various types of statistical analysis. Differences between the three methods of analysis—analog, digital, and theoretical—are determined and analyzed. Methods for reducing some of these differences are suggested and illustrations of improvements are presented. The applicability of analog and digital techniques to the analysis of various kinds of data is discussed and time requirements are compared. The statistical accuracy of the analysis is investigated. Accuracy is compared with results reported in the literature and in the case of the autocorrelation analyzer, an empirical expression for statistical accuracy is determined. Author

N66-28476# Gulton Industries, Inc., Trenton, N. J.
AUTOMATIC REAL-TIME VIBRATION SPECTRUM ANALYZER SYSTEM USING DELAY LINE TIME COMPRESSION TECHNIQUES
John L. Fryling *In* NRL The Shock and Vibration Bull. Feb. 1966 p 209–221 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

An automatic hybrid analog/digital system designed for on-line processing and analysis of vibration and acoustic data signals is described. The system uses time compression techniques to assist in real time operation. Data can be analyzed for frequency spectrum on both an amplitude and power basis, cross power spectra, autocorrelation, and cross correlation. The system provides analog outputs for oscilloscope display and digital outputs in IBM compatible format. Time compression is provided by two sets of recirculating delay line circuits. Time compression allows the use of a high i.f., fast sweeping, wide bandwidth, heterodyne spectrum analyzer for spectral analysis. Time delays for auto- and cross-correlation are generated by inserting extra delay in one set of delay lines, allowing one data channel to process in time with respect to the other. The vibration and acoustic analysis system provides spectrum analysis and time correlation for signals between 0.01 and 20,000 cps. Signals above 5 kc are heterodyned down to frequencies below 5 kc. Author

N66-28477# Atomics International, Canoga Park, Calif.
THE ANALOG CROSS SEPCTRAL DENSITY ANALYZER SYSTEM
R. L. Randall *In* NRL The Shock and Vibration Bull. Feb. 1966 p 223–230 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25
(Contract AT(11-1)-GEN-8)

An analog data analyzer system designed for measuring input-output characteristics of systems under dynamic test is described. This system is designed to handle essentially all types of analog test data recorded on either magnetic tape or strip charts, including random, periodic, or transient signals. Typical measurements that may be performed include: (1) spectral amplitude, (2) power spectral density, (3) transmissibility, (4) cross spectral density (coincident, quadrature, and magnitude), and (5) gain, phase, and coherence (the degree of linear correlation between any two signals at each frequency). Variations in the system permit the detection and analysis of both stationary and nonstationary excitation and response data, and the study of systems with both linear and nonlinear response characteristics. Outputs from the analyzer are recorded as functions of time or frequency in either analog or digital form. Author

N66-28546# Joint Publications Research Service, Washington, D. C.
STUDIES IN BIOLOGICAL AND MACHINE MEMORY
24 May 1966 34 p refs Transl. into ENGLISH from the book "Operativnyye i Postoyannye Zapominayushchiye Ustroystva" Leningrad, Energiya Publishing House, 1964 p 164–186 (JPRS-35864; TT-66-32099) CFSTI: $2.00

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2. CERTAIN MECHANISMS OF THE BRAIN PARTICIPATING IN IMPRESSIONING N. A. Aladzhalova p 10–17 refs (See N66-28548 16-05)
3. A POSSIBLE MODEL OF A NETWORK POSSESSING ASSOCIATIVE MEMORY R. M. Granovskaya and V. A. Ganzen p 18–26 refs (See N66-28549 16-08)

N66-28547# Joint Publications Research Service, Washington, D. C.
PROBABILITY CHARACTERISTICS OF INFORMATION REPRODUCTION IN A LIVING AND IN A MACHINE MEMORY
A. F. Gorshkov *In its* Studies in Biol. and Machine Memory 24 May 1966 p 1–9 refs (See N66-28546 16-08) CFSTI: $2.00

A deterioration model of reaction probabilities, based on a mathematical model of the conditioned reflex, as well as on certain positions of statistical physics and pedagogics, was constructed. The concepts of memory domain and information complex are introduced to facilitate algorithmization of the indicated operators in the mathematical model. The memory domain is defined as the combination of biophysical formations participating in the storage of a given complex of information which may be any cipher, number, word, group of words, sentences, etc. Application is discussed for both human and machine memory storage units in the learning process. The relaxation process of machines, equated to the process of human forgetting, is illustrated by a differential equation. Calculation points corresponding to the probabilities at the completion moment of the preservation cycles are depicted graphically, with the probability of machine reproduction, or human memory recall indicated. It is expected that the necessary number of perception cycles for each student can be determined beforehand. R.Li.

N66-28548# Joint Publications Research Service, Washington, D. C.
A POSSIBLE MODEL OF A NETWORK POSSESSING ASSOCIATIVE MEMORY

R. M. Granovskaya and V. A. Ganzen *In its* Studies in Biol. and Machine Memory 24 May 1966 p 18–26 refs (See N66-28546 16-08) CFSTI: $2.00

In connection with optimization of computer memory devices, a feasibility model of a plastic neuron network, in which a number of associative memory properties are realized, is examined. Association, or the union of codes registered in the memory, according to proximity and similarity is reported. A figure depicts a diagram of a neuron model, which is defined as a system with n inputs and one output. A structural diagram of an input–output network, and a general diagram of the associative network are pictured. The system examined exhibits properties characteristic of human memory. Recording and comparison of information occur sequentially. The preference of selection (under equally stable conditions) falls within the high excitation area. Between any two words (arriving at different inputs or at a single input), an associative connection can be formed that may also occur in human memory. R.Ll.

N66-28586# Radio Corp. of America, Camden, N. J. Defense Electronic Products.
COMPUTER PROGRESS
[1965] 90 p refs

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N66-28587# Radio Corp. of America, Camden, N. J.
VIDEOSCAN—HIGH-SPEED OPTICAL READER FOR COMPUTER INPUT
J. L. Miller and S. Klein *In its* Computer Progr. [1965] p 10-13 refs (See N66-28586 16-08)

Videoscan is an optical character reader that is available for RCA computer input (on-line), using an RCA vidicon and providing a maximum tolerance of printed-character variations. It reads and converts to computer language a set of stylized numeric characters at a peak rate of 1,500 characters/sec—in the application described here, the numerals 0 through 9, and the symbols period, dash, asterisk, and dollar-sign. Its primary application is to high-volume accounting operations, where large volumes of data are generated by the computer that might be returned to the system as input. Videoscan, therefore, reads "turn-around documents"—i.e., data documents from the high-speed printer, which can both be easily read by humans and, through Videoscan, used as high-speed computer input. The experience gained in developing this product-line equipment is applicable to future generations of more-sophisticated optical character readers. Originally designed for RCA 301 and 3301, a new model of the Videoscan for the Spectra 70 Series incorporates several improvements and increased capabilities. Author

N66-28590# Radio Corp. of America, Camden, N. J.
ADVANCED COMPUTER TECHNOLOGY IN RCA A Review
J. A. Brustman *In its* Computer Progr. [1965] p 42–47 refs (See N66-28586 16-08)

This paper reviews the history and present trends in advanced-development work on computers at RCA. Emphasis is given the Vanguard program, which was conducted by RCA to explore the trends that advanced computers would follow. Also discussed are significant future trends for computer circuits, memories, and packaging. This review illustrates the role that the Computer Advanced Product Research activity plays in RCA computer research and development. That role includes high-speed digital theory, logic design, circuit development, memory development, and advanced fabrication. The work regularly ranges from theoretical analysis through practical, economical equipment solutions that are tested in feasibility models. Author

N66-28593# Radio Corp. of America, Camden, N. J.
AUTOMATA THEORY—AN AID TO COMPUTER DESIGN
Ann S. Merriam *In its* Computer Progr. [1965] p 56–60 refs (See N66-28586 16-08)

The growth of automata theory has been stimulated more by the development of computers than by any other outside agent. This paper surveys its contribution to computer technology, with special attention given to the finite-state sequential machine, which in three examples, is shown as a planning aid in logic design and programming. Moreover, it

is suggested that applied automata theory holds promise to surmount difficulties of complexities of logic and function, to enforce consistency during design, and to help diagnose ills in debugging. Author

N66-28594# Radio Corp. of America, Princeton, N. J.
MEMORIES IN PRESENT AND FUTURE GENERATIONS OF COMPUTERS
J. A. Rajchman *In* RCA, Camden, N. J. Computer Progr. [1965] p 61–65 refs (See N66-28586 16-08)

The core memory is reaching capacities of several million bits, cycle times of a fraction of a microsecond and of constantly lower cost. This is due to gradual improvements and to high speed automatic fabrication and testing of cores. The memories of the RCA Spectra 70 illustrate these advances. Batch fabricated integrated techniques are likely to provide the next important improvement. Two developments are promising. The RCA monolithic ferrite memory is made by economic techniques requiring no wiring, comprises closed flux elements packed many thousand to the square inch, is driven by a unique type of integrated diodes, has submicrosecond cycle time and is extensible to relatively large storage capacities. For large capacities, in excess of hundred million bits, the superconductive memories are most promising. A single thin film batch fabrication process produces the storing structure, the addressing circuits, and all interconnections. Solutions to various problems remain to be fully demonstrated but there appears to be no fundamental barrier to eventual realization. Possibilities of all-semiconductor MOS and TFT memories have been shown in the laboratory. Author

N66-28595# Radio Corp. of America, Princeton, N. J.
RESEARCH ON A COMBINED MOS-CIRCUIT, MONOLITHIC-FERRITE INTEGRATED CIRCUIT
R. A. Shahbender *In* RCA, Camden, N. J. Computer Progr. [1965] p 72–75 refs (See N66-28586 16-08)

The continuing RCA Laboratories research program on integrated memories has led to the approach described in this paper, wherein a monolithic-ferrite (also called a laminated-ferrite) stack is integrated with integrated MOS circuitry. Many advantages will accrue from such a batch-fabrication of large-capacity memory stacks. The particular laboratory approach described herein involves a stack of 10^7-bit capacity, cycle-time of a few microseconds, and a cost of less than 1 cent per bit. Author

N66-28749*# Oak Ridge National Lab., Tenn.
INSTRUCTIONS FOR THE OPERATION OF CODES ASSOCIATED WITH THE LOW-ENERGY INTRANUCLEAR CASCADE CALCULATION
Hugo W. Bertini, Hemma E. Francis, and Miriam P. Guthrie Mar. 1966 149 p refs
(NASA Order R-104; Contract W-7405-ENG-26)
(NASA-CR-75895; ORNL-3844) CFSTI: HC $4.00/MF $1.00
CSCL 09B

Instructions are given for processing a tape containing all the programs associated with a low-energy intranuclear cascade calculation. The calculation is valid for incident nucleon energies from about 50 to 350 MeV and for incident charged pion energies from about 50 to 250 MeV. The codes involved are the cascade code, two analysis codes which construct various histograms using the data generated by the cascade, an evaporation code which performs evaporation calculations on the nuclei that are left at the completion of the cascade calculation, an angular momentum code, and a code which allows the cascade calculations to be made with different nucleon density distributions within the nucleus. A detailed description of all the binary outputs is given, and a list of running times is included. Author

N66-28782*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
GUIDANCE COMPUTER DESIGN
Albert Hopkins *In its* Space Navigation Guidance and Control, Vol. 2 Jun. 1965 83 p refs (See N66-28759 16-21)
CFSTI: HC $6.00/MF $1.50

The extension of guidance computer technology is assessed for appliction in the Apollo navigation and guidance systems for the Command and Lunar Excursion Modules. The Apollo guidance computer functions are defined as aiding in operation of the inertial and optical subsystems, providing steering signals when human reaction is too slow, performing spacecraft attitude control, maintaining timing references, communicating with astronauts by means of display lights and keyboard, communicating with ground tracking stations via digital data links, and performing the calculations necessary to deduce position and velocity relative to the earth and moon from the input data during all flight phases. Characteristics, requirements, logical design, hardware, interface methods, utility programs, manufacturing, and program preparation are illustrated and discussed. L.E.W.

N66-28779# Joint Publications Research Service, Washington, D. C.
ELECTRONIC COMPUTERS
L. N. Korolev and V. M. Bryabrin 13 Jun. 1966 59 p refs Transl. into ENGLISH of the publ. "Ekaltronnyye Vychislitel'nyye Mashiny" Moscow, Acad. of Sci. USSR, 1965 p 1–87
(JPRS-35972; TT-66-32408) CFSTI: $3.00

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3. THE VIRTUAL MEMORY OF HIGH-SPEED DIGITAL COMPUTERS V. M. Bryabrin p 36–52 refs (See N66-28782 16-08)

N66-28780# Joint Publications Research Service, Washington, D. C.
AN ALGORITHM FOR AUTOMATIC DISTRIBUTION OF OPERATIVE MEMORY
L. N. Korolev *In its* Electron. Computers 13 Jun. 1966 p 1–6 refs (See N66-28779 16-08) CFSTI: $3.00

An algorithm of information rejection and pumping, used in operative computer memories is analyzed to attain effective usage of the operative memory and to see that information with relatively low accessing frequency is located in the alloted time. Two conditions are placed on this type of algorithm: first that the algorithm should not be based on preliminary knowledge of the structure of the program on which the dynamics of the intensity of usage of the various parts of the memory depend in the final analysis; and second, that the algorithm should provide analysis and

operation rapidly (leaving sufficient time to the central processor for solution of the problems placed in the computer). L.S.

N66-28781# Joint Publications Research Service, Washington, D. C.
MODELING OF A MEMORY SYSTEM INCLUDING A BUFFER ASSOCIATIVE MEMORY UNIT
V. M. Bryabrin *In its* Electron. Computers 13 Jun. 1966 refs p 7-35 (See N66-28779 16-08) CFSTI: $3.00

A model of an operative computer memory system which includes a buffer associative memory unit is presented for investigating its operation independently from other parts of the computer system. A general description of such modeling programs is presented; and methods of using buffer memories in computers are discussed. Also discussed are (1) the design of buffer memory units, (2) the order in which the buffer memory cells are filled, and (3) the establishment of a priority for the buffer memory cells. Characteristics of the system modeled are given, and the modeling results are interpreted. The results of the model can be used for selecting optimal buffer memory parameters and constructing corresponding computer systems. L.S.

N66-28782# Joint Publications Research Service, Washington, D. C.
THE VIRTUAL MEMORY OF HIGH-SPEED DIGITAL COMPUTERS
V. M. Bryabrin *In its* Electron. Computers 13 Jun. 1966 p 36-52 refs (See N66-28779 16-08) CFSTI: $3.00

The general operational sequence of a digital computer in performance of an individual instruction is analyzed. A block diagram of the connections between the various components of the computer, and a time diagram depicting the operation of the devices in performance of one instruction are presented. The organization of the computer virtual memory is based on the use of an associative memory unit in the system. The system of virtual memory considered is divided into three separate units. During operation all three units are connected, which causes an increase in the effectiveness of the system. Also discussed are the virtual instruction memory (VIM) and virtual operations memory (VOM) units. L.S.

N66-28933# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
CURVE PLOT FOR "SCISRS"
Marian M. Melnick Nov. 1965 42 p refs
(Contract SNP-1)
(WANL-TME-1317) CFSTI: HC $2.00/MF $0.50

The Fortran II program, Curve Plot for SCISRS (CPS) is used for plotting cross section data from the SCISRS (Sigma Center Information Storage and Retrieval System) library. The program is given along with results of sample calculations. NSA

N66-28983# Iowa State Univ. of Science and Technology, Ames.
TASK 65: A CONSEQUENT PROCEDURE REAL TIME COMPUTER LANGUAGE
D. R. Fitzwater and D. E. Mc Farland Nov. 1965 68 p
(Contract W-7405-ENG-82)
(IS-1280) CFSTI: HC $3.00/MF $0.75

A complete description of a real-time multiprogramming computer language is given in the fashion of the ALGOL 60 report. Consequent procedures are defined by the consequences of previous (in time) procedures rather than by the programmer. The use of these concepts leads to a comparatively simple system and a very powerful real-time programming language. The language is developed with ALGOL 60 as a base for modification. Author (NSA)

N66-28984# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
UNPACK: NEUTRON CROSS SECTION DATA RETRIEVAL PROGRAM
C. V. Smith and M. K. Drake 1 Sep. 1965 40 p refs
(Contract AT(04-3)-167)
(GA-6685) CFSTI: HC $2.00/MF $0.50

A program was written for the retrieval of neutron cross section data and related information from a Brookhaven National Laboratory SC/SRS data tape. This program, UNPACK, was written in FORTRAN IV and MAP machine language for the IBM-7044. The SC/SRS tape contains neutron cross section data in a packed format and the UNPACK code searches through these data for particular cross sections. The retrieved data are then printed and may also be punched on cards. NSA

N66-29039# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
A COMPUTER PROGRAM FOR FINDING COMPLEX ZEROS OF AN ARBITRARY FUNCTION
B. Mc Namara Sep. 1965 34 p
(CLM-R-48) HMSO: 5s

A computer program is described which finds complex zeros of arbitrary functions by iteration from some given initial guesses. The basis of the iteration is to approximate the given function by simpler functions whose zeros can by simply calculated. The regions of the complex plane in which the iteration converges to a required zero are greatly extended by several ad hoc procedures developed in a study of helicon wave propagation. The program is constructed in such a way as to allow indefinite extension of the facilities offered without reference to the original programming. The helicon wave problem is used as an illustrative example and simple methods by which more complicated eigenvalue problems can be solved are indicated. Operating procedures are included. Author (NSA)

N66-29050# Atomic Energy Commission Research Establishment, Riso (Denmark).
ON-LINE ANALOGUE COMPUTER FOR ELECTRON SPIN RESONANCE SPECTROMETER
K. Soee Hoejberg Apr. 1965 15 p refs
(RISO-M-233)

Analog equipment for double integration of electron spin resonance spectra is described. The given circuit performs computation of correction terms for drift in the input signal from electron spin resonance spectrometer.
Author (NSA)

N66-29061# California Univ., Berkeley. Lawrence Radiation Lab.
TRIST—A TRILEVEL MULTIPROGRAMMING EXECUTIVE COORDINATING REAL-TIME PROCESSING OF DATA FROM AN ASYNCHRONOUS ON-LINE DEVICE WITH DATA ANALYSIS AND BACKGROUND PROGRAMS

Carol Osborne, Robert Larson, Thomas Oliver, Joan Pinchak, and Howard S. White 26 Oct. 1965 17 p refs Presented at the Spring Joint Computer Conf., Boston, 1966
(Contract W-7405-ENG-48)
(UCRUL-16481; CONF-660407-1) CFSTI: HC $1.00/MF $0.50

TRIST is a trilevel multiprogramming executive designed both to coordinate computer operations with a real-time asynchronous device attached on-line to an IBM 7094 II and to make the computer time between real-time demands available for other uses. Although designed for these specific purposes, many of the ideas incorporated in the program are basic to any multiprogramming problem, and several of the special features included in the memory-protect routine, priority handling of subroutine use, loop and halt detection, and quality control are of particular interest. Author (NSA)

N66-29101# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
DEMON—A PROGRAMME GENERATOR FOR PROBLEMS INVOLVING ORDINARY DIFFERENTIAL EQUATIONS
N. W. Bennett Aug. 1965 210 p refs
(AAEC/E-142)

DEMON is a system designed to solve problems involving ordinary differential equations as quickly as possible. It accepts differential equations in the D-Notation (that is, $y' = y + y'$ is expressed as D2Y=Y+DY), and generates a FORTRAN program to solve the problem. A means is provided for solving boundary equation problems. New integration methods may be defined to DEMON together with the problem. These methods may range from Predictor-Corrector to Gaussian quadrature. Non-self-starting methods are automatically started. The DEMON program was written in COBOL and should be suitable for any large machine. At the A.A.E.C. Research Establishment the DEMON system is working on a 32K IBM-7040, where the time taken from completely defining the problem to receiving the results may be as short as ten minutes. Author (NSA)

N66-29111# California Inst. of Tech., Pasadena. Synchrotron Lab.
A GENERAL RANGE-ENERGY-LIGHT OUTPUT PROGRAM FOR HIGH ENERGY PHYSICS
Donald E. Groom 31 Dec. 1965 11 p
(Contract AT(11-1)-68)
(CALT-68-62) CFSTI: HC $1.00/MF $0.50

A computer program for calculating a particle's energy loss and light output as it passes through a variety of absorbers and counters is described. NSA

N66-29113# Chicago Univ., Ill. Inst. for Computer Research.
ICR QUARTERLY REPORT NO. 8
Richard H. Miller 1 Feb. 1966 64 p refs
(Contract AT(11-1)-614)
(COO-614-43) CFSTI: HC $3.00/MF $0.75

Further research developments are reported on the Maniac III engineering activity, instructions, and the Man-Machine project. In addition, brief papers are presented on the following: syntactic analysis of ALGOL programs containing errors, matrix operations, construction of fixed points and solutions of nonlinear equations with demicompact mappings, and a large Michelson stellar interferometer. NSA

N66-29117# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
GAPS: A FORTRAN CODE FOR ANALYZING DATA FROM PULSED NEUTRON SOURCE EXPERIMENTS
J. R. Brown and K. R. Van Howe 11 Oct. 1965 45 p refs
(Contract AT(04-3)-314)
(GAMD-6781) CFSTI: HC $2.00/MF $0.50

GAPS, a FORTRAN IV-IBM 7044 program, will perform the following operations on the raw data counts obtained on a multichannel analyzer during a pulsed neutron source experiment on a multiplying assembly: make count loss corrections based on an input system resolving time for a Pulsed Neutron Logic Plug-in Unit, background subtraction of the corrected background, least squares fit an exponential to the decay of the fundamental mode, with the beginning and end points of the fit being input numbers, and perform the integration and iterations required to obtain the subcritical reactivity and the β/Δ by the Garelis and Russell prescription. NSA

N66-29118# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
FASDOP—A FORTRAN IV COMPUTER PROGRAM FOR COMPUTING CROSS SECTIONS FROM RESONANCE PARAMETERS
C. A. Stevens 9 Aug. 1965 13 p
(Contract AT(04-3)-167)
(GAMD-6562) CFSTI: HC $1.00/MF $0.50

The FASDOP computer program evaluates pointwise cross sections from single level Breit-Wigner resonance parameters. For any single problem it can handle up to 500 resonances and compute cross sections for a maximum of 2500 energies. Author (NSA)

N66-29123# Battis Atomic Power Lab., Pittsburgh, Pa.
MO565: A PROGRAM TO SOLVE A RECTANGULAR MAGNETIC NETWORK FOR USE ON THE PHILCO-2000 COMPUTER
D. A. Guerdan Feb. 1966 28 p ref
(Contract AT(11-1)-GEN-14)
(WAPD-TM-557) CFSTI: HC $2.00/MF $0.50

MO565 is a digital computer program to find the magnetic flux in each branch of a magnetic network consisting of a large number of branches of iron and air. The magnetomotive force driving flux in the network is not concentrated in any one branch, and the iron branches need not have the same saturation characteristic. The problem is solved by assimilating the magnetic network to an electrical network and using Kirchkoff laws of current and voltage. Several iterations are needed, and the program stops when the error is smaller than a criterion of convergence specified in the input. The network is of rectangular shape and consists of a maximum of 15 double loops plus three outside loops. Author (NSA)

N66-29130# Illinois Univ., Urbana. Coordinated Science Lab.
AN EFFICIENT RECOGNITION AND SYNTAX-ANALYSIS ALGORITHM FOR CONTEXT-FREE LANGUAGES
T. Kasami Mar. 1966 52 p refs
(Contracts DA-28-043-AMC-00073(E); AF 19(628)-4379; Grant NSF GK-690)
(R-257; AD-631692) CFSTI: HC $5.00/MF $0.50

An efficient algorithm of recognition and syntax-analysis for the full class of context-free languages without the

difficulty of exponential growth of computing time with the length n of input sequence is presented. This algorithm makes use of a fundamental algebraic property of a context-free language. It is shown in this paper that a context-free language is n^3 recognizable in the sense of Hartmanis and Stearns by a double-tape or double-head single-tape Turing machine and it is n^4—recognizable by a single-head single-tape Turing machine. The size of memory required for recognition is proportional to n^2. If we use a random-access memory whose size is proportional to n^2, the computing time required for syntax-analysis is upper-bounded by $C_1n^3+C_2n^2N$, where N denotes the number of non-equivalent valid derivation sequences for a given input sequence and C_i's are constants independent of input sequences. If we use two tapes of length C_3n^2 and two tapes of length C_4n as working memories, the computing time for syntax-analysis is upper-bounded by $n^3(C_5+C_6N)$. TAB

N66-29137# Massachusetts Inst. of Tech., Cambridge.
DESIGN OF A LOW-COST CHARACTER GENERATOR FOR REMOTE COMPUTER DISPLAYS
Thomas Burrell Cheek (M.S. Thesis) Mar. 1966 71 p refs
(Contract Nonr-4102(01); Proj. MAC)
(MAC-TR-26; AD-631269) CFSTI: HC $3.00/MF $0.75

A requirement exists for a low-cost remote display terminal with alphanumeric and line-drawing capabilities for use with time-shared computer systems. A survey of existing devices and character generation techniques was carried out, and a design approach was chosen which takes advantage of mass-fabrication techniques. This includes using a five-by-seven dot matrix raster and a resistor array 'read-only' character memory for the 96 printable symbols of the Revised Proposed ASCII Code. Circuits designed included a dot matrix generator, and a resistor array memory with selection logic sense amplifiers, and a shift register output buffer. An experimental character generator with an eight-word memory was built, largely using integrated circuits and was found to work as desired. It is concluded that the design approach will yield a character generator that is of low enough cost to find wide use in remote computer terminals.
Author (TAB)

N66-29146# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
SOME RESULTS ON THE BINARY CONVOLUTIONAL TREE CODE GENERATORS Scientific Report No. 5
Shu Lin 15 Dec. 1965 46 p refs
(Contract AF 19(628)-4379)
(AFCRL-66-73; AD-631864) CFSTI: HC $2.00/MF $0.50

A simple and practical search procedure for obtaining the binary convolutional tree code generators is presented. A tabulation of the good generators of rate 2/3, and 1/12 is given. The codes of rate 1/2 and 1/3 found by this procedure are comparable with Bussgang's results by exhaustive searching.
Author (TAB)

N66-29151# Goodyear Aerospace Corp., Akron, Ohio.
ADVANCED COMPUTER ORGANIZATION STUDY. VOLUME I: BASIC REPORT Final Report, Aug. 1964–Nov. 1965
Donald L. Rohrbacher Griffiss AFB, N. Y., RADC, Apr. 1966 82 p refs
(Contract AF 30(602)-3550)
(GER-12314, Vol. I; RADC-TR-66-7, Vol. I; AD-631870) CFSTI: HC $3.00/MF $0.75

Advanced general-purpose computer organizations capable of parallel data processing were studied. The study resulted in the design of two computer organizations (designated Machine I and Machine II) capable of parallel data processing and fast sorting and table searching in memory. These machine organizations were possible because of the development of a special memory that permits many processing and input-output units to access memory simultaneously without conflict. The applications effort was focused on the development of solution models which exploited the maximum amount of parallelism resident within a problem. Two major problems were investigated: a dynammic programming problem, and parallel compilation. Detailed programs were written for the dynamic programming problem on Machine I and a parallel compilation algorithm on Machine II. These same problems also were programmed on the IBM 7090 to provide a standard of comparison. In both cases, the parallel processing capability of the machines afforded significant increases in speed of program execution.
Author (TAB)

N66-29154# Goodyear Aerospace Corp., Akron, Ohio.
ADVANCED COMPUTER ORGANIZATION STUDY. VOLUME II: APPENDIXES Final Report, Aug. 1964–Nov. 1965
Donald L. Rohrbacher Griffiss AFB, N. Y., RADC, Apr. 1966 409 p refs
(Contract AF 30(602)-3550)
(GER-12314, Vol. II; RADC-TR-66-7, Vol. II; AD-631871) CFSTI: HC $7.15/MF $2.00

Contents: Parallel execution of the dynamic programming technique; programming of the dynamic programming technique for the IBM 7090 (sequential); programming of the dynamic programming technique for machine I (parallel); programming manual for machine I; bi-tonic sorting; basic organization of machine I; parallel merging-separating networks; problem selection for a parallel processor; macro instructions for a parallel processor; parallel compilation; programming of the sequential compilation algorithm for the IBM 7090; machine II programming; programming manual for machine II; basic organization of machine II; parallel non-numeric processing.
Author (TAB)

N66-29156# California Univ., Berkeley. Operations Research Center.
OPTIMAL ASSIGNMENT OF COMPUTER STORAGE BY CHAIN DECOMPOSITION OF PARTIALLY ORDERED SETS
George B. Dantzig and Gary H. Reynolds Mar. 1966 13 p refs
(Contract Nonr-222(83); Grants NIH GM-9606; NSF GP 4593)
(ORC-66-6; AD-631839) CFSTI: HC $1.00/MF $0.50

To save storage, a program is usually written so that each variable assumes several values. As a result, a program is usually difficult to understand and prone to errors. For an important class of programs, it will be shown that they can be written with complete freedom in the naming of variables; leaving the task of minimizing storage requirements to the computer itself.
Author (TAB)

N66-29269# General Electric Co., Huntsville, Ala.
GENERALIZED FORM CONTROLLED INPUT PROGRAM
Philip Crabb Huntsville, Ala., Redstone Sci. Inform. Center, Mar. 1966 30 p
(Contract DA-01-021-AMC-242(Z))
(RSIC-541; AD-632208) CFSTI: HC $2.60/MF $0.50

This report describes a computer program for an 8K IBM 1401 Computer designed to test the hypothesis that a generalized program can be written to identify and format data elements in paper tape records generated as a by-product of filling in any standard form on a keyboard-operated paper tape device. Input to this program is provided by a utility run which converts paper tape records to magnetic tape images of those records rather than accepting input directly from paper tape. The standard form is described to the program by means of control cards which specify the data elements, their respective locations on the form, and the data element code (3-character identifier) to be assigned to each data element. A maximum of 110 data elements can be accommodated. Using the control cards as criteria, the program evaluates the paper tape data in terms of functional codes (Carriage Returns, Tabs, Backspaces, etc.) to identify data elements, justify them accordingly, perform minor edits, and assign appropriate data element codes as required. In this prototype program, line length may not exceed 99 characters and the number of lines may not exceed 99. Author (TAB)

N66-29338*# National Aeronautics and Space Administration, Washington, D. C.

AUTOMATIC ANALOG COMPUTER CONTROL BY MEANS OF PUNCHED CARDS–"CRESSIDA I" [CONTROLE AUTOMATIQUE DES CALCULATEURS ANALOGIQUES A L'AIDE DE CARTES PERFOREES–"CRESSIDA I"]

Armand Van Wavve Apr. 1964 28 p refs Transl. into ENGLISH of CETIS Rept. No. 46, Brussels, EURATOM, Apr. 1962 (NASA-TT-F-8843) CFSTI: HC $2.00/MF $0.50 CSCL 09B

A card-fed input and output system for an analog installation is described, which can be used for automating operations involved in static coupling. An automatic digital input output system (ADIOS) console was linked with an IBM 026 card punch and modified so that the combination formed a unit capable of both reading and inserting analog quantities on cards. The importance of this system is stressed with regard to digital–analog coupling projects and processing of the APACHE code on the IBM 7090 computer. Advantages and functions of the ADIOS/026 combination are listed, as well as instructions for using the system. Schematics are included, and component functions are described. S.P.

N66-29484# System Development Corp., Santa Monica, Calif.

RESEARCH INTO THE MANAGEMENT OF COMPUTER PROGRAMMING: A TRANSITIONAL ANALYSIS OF COST ESTIMATION TECHNIQUES

G. F. Weinwurm and H. J. Zagorski Nov. 1965 221 p refs Includes errata sheet

(Contract AF 19(628)-5166)

(TM-2712/000/00; TM-2712/000/00A; AD-631259) CFSTI: HC $6.00/MF $1.25

The report embodies results of a continuing research effort on development of management guidelines, standards, and techniques of computer programming. The report focuses on a statistical analysis of 74 completed computer programming jobs in terms of their resource-costs and related variables. The primary results are: indices of job difficulty, job type, development environment, and job uniqueness; a costliness factor that permits programming tasks to be ranked in this respect; weighted composites of the indices for estimating the cost of particular programming jobs; and scoring and confidence-band techniques for blending intuitive managerial judgments with the formal cost-estimation procedures. Supplementary findings include indications of the relative sensitivity of job cost to changes in the values for the indices, and preliminary comparisons of resource usage between programs produced in machine-oriented or procedure-oriented languages. Recommendations are made for the collection of more accurate and current data on programming jobs during the production cycle, and the development of a census of computer programming, to enable the design of precise sampling experiments for subsequent analyses. Author

N66-29557# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.

AN INTRODUCTION TO SAMPLED DATA AND SWITCHING LOGIC

Thomas L. Davis 1 Apr. 1966 78 p refs (NBS-TN-334)

This note presents introductory material on the subjects of Fourier series and integral representations of data, operations on data (i.e., correlation, convolution, and sampling), Boolean algebra, and combinatorial logic circuits. The presentation is tutorial and stresses the operations and their effects rather than mathematical rigor. Author

N66-29589# Applied Data Research, Inc., Princeton, N. J.

INFORMATION SYSTEM THEORY PROJECT. VOLUME I: MEM THEORY—A MATHEMATICAL METHOD FOR THE DESCRIPTION AND ANALYSIS OF DISCRETE, FINITE INFORMATION SYSTEMS Final Report

Anatol W. Holt, Spencer O. Chagnon, Robert M. Shapiro, and Stephen Warshall (Computer Associates, Inc.) Griffiss AFB, N. Y., RADC, Nov. 1965 194 p Prepared in part by Computer Associates, Inc., Wakefield, Mass.

(Contract AF 30(602)-3324)

(RADC-TR-65-377, Vol. I; AD-626819) CFSTI: HC $5.00/MF $1.00

A discrete information system may be abstractly conceived as a domain of 'entities' characterized as to the following: an ensemble of possible states of mutual relation; a collection of possible 'local' transformations of system state; and 'coupling' possibilities which determine how the system may interact with 'environments.' As between several such systems, relations such as 'behavioral equivalence' and 'representation' may be defined. In respect to computer systems, the most diverse information processing and/or exhibiting 'devices,' whether hard or soft or a combination of both, are to be amenable to mem-theoretic treatment. From the point of view of automata theory, mem-theory provides a method for constructing deterministic or non-deterministic finite state automata to explicate some informally-given interesting varieties of complex, discrete behavior. From such treatment, one is to obtain the capacity to describe, contrast and evaluate alternate organizational techniques and to be led to the invention of new ones. Author (TAB)

N66-29690# Radiation Research Associates, Inc., Fort Worth, Tex.

MONTE CARLO CODES FOR STUDY OF LIGHT TRANSPORT IN THE ATMOSPHERE. VOLUME II: UTILIZATION INSTRUCTIONS Final Report, 1 Jul. 1964–31 Jul. 1965

David G. Collins and Michael B. Wells Fort Monmouth, N. J., Army Electron. Command, Aug. 1965 102 p
(Contract DA-28-043-AMC-00240(E))
(RRA-T54-II; ECOM-00240-F, Vol. II; AD-625116) CFSTI: HC $5.00/MF $1.00

Monte Carlo procedures designated at LITE-I and LITE-II were developed to study the transport of light through the earth's atmosphere under various environmental conditions. LITE-I treats monochromatic light emitted from a point source, and LITE-II treats monochromatic plane sources of light. The codes have been written in both ALGOL for the Burrough's B-5000 and FORTRAN II for other computers. The codes are sufficiently flexible to treat multiple scattering in an atmosphere in which air density and aerosol size distribution vary independently and arbitrarily with altitude. Provision for treating ground and cloud reflection with an albedo method is also available in the codes. The codes have been verified through comparisons with other calculations of light transport in the atmosphere. Utilization instructions, input data formats, sample problems, and the ALGOL listings of the codes are given to aid those who wish to utilize the codes. Author (TAB)

N66-29594# David Taylor Model Basin, Washington, D. C. Applied Mathematics Lab.
A LARC MASTER CONTROL ROUTINE (MCR4)
Sara E. Kenady Jan. 1966 56 p refs
(DTMB-2125; AD-630245) CFSTI: HC $5.60/MF $0.50

This report describes an operating system developed for code checking, data processing, and batch running of UNIVAC-LARC routines. It is a general purpose extension of the FLAME Master Control System described in Model Basin Report 1863 (AD-611775). Author (TAB)

N66-29595# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
LINEAR NETWORK SENSITIVITY MINIMIZATION PROCEDURE
D. A. Calahan Washington, AFOSR, 1 Feb. 1966 23 p ref
(Grant AF-AFOSR-948-65)
(AFOSR-65-1931; AD-630136) CFSTI: HC $2.60/MF $0.50

Procedures are given for minimizing the sensitivity of one or more of the poles to changes in any network elements, and of the frequency response to changes in any network elements. The program can be used if a network N_1 realizes a network function T(s). A sensitivity function as the sum of squares, where the contents of each squared term is a weighted linear sum, is presented as an application. Element values of variables in the original and final design are tabulated and the improvement of sensitivity is shown graphically. In the optimization procedure the weighted root sensitivities are calculated for the initial and final designs. For Bode sensitivity minimization, the value of each sensitivity sum is calculated for the same designs. It is pointed out that the use of the Bode sensitivity criterion in higher order networks should be discouraged, since convergence is difficult in such cases. Even the magnitude of the root sensitivity is difficult to minimize for higher order cases; real and imaginary part root sensitivity minimization is more natural to the algorithm used. R.Ll.

N66-29613# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
AN EXTENSION OF APT TO OBTAIN CENTROID AND INERTIA INFORMATION
A. H. Fowler and C. W. Wilson 16 Feb. 1966 27 p
(Contract W-7405-ENG-26)
(Y-1420, Rev. 1) CFSTI: HC $2.00/MF $0.50

Computer routines are described which can be used with the APT system to obtain centroids and inertias of plane surfaces and solids of revolution. Author (NSA)

N66-29651*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
DATA ANALYSIS AND REPORTING
Scott H. Simpkinson, Victor P. Neshyba, and J. Don St Clair *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 263-269 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The acquisition of vast quantities of data combined with a need to evaluate and quickly resolve mission anomalies has resulted in a new approach to data reduction and test evaluation. The methodology for selective reduction of data has proved effective and has allowed a departure from the traditional concept that all test data generated must be reduced. Realtime mission monitoring by evaluation engineers has resulted in a judicious selection of flight segments for which data need to be reduced. This monitoring, combined with the application of compression methods for the presentation of data, has made it possible to complete mission evaluations on a timely basis. Author

N66-29705# New York Univ., N. Y. Lab. for Electroscience Research.
PATTERN ANALYSIS OF PLANAR GEOMETRIC CONFIGURATIONS Final Report, Jan. 1-Dec. 31, 1965
Herbert Freeman [1965] 35 p refs
(Grant AF-AFOSR-24-65)
(AFOSR-66-0776; AD-632365) CFSTI: HC $2.00/MF $0.50

This report describes the results of a research study in pattern analysis and related topics. The study covered six separate investigations. These were: (1) quantization of line-drawing data, (2) a mathematical model for contour maps, (3) the two-dimensional hidden-line problem, (4) the segment fitting problem, (5) the optimum two-dimensional allocation problem, and (6) a study of two-way communication between computers with interference delay. The report briefly summarizes the investigations and lists the publications resulting from the research work. Author (TAB)

N66-29720# Sandia Corp., Albuquerque, N. Mex.
MAGNETICS TECHNOLOGY IN ADVANCED DATA SYSTEMS Status Report
J. B. Szymanski Nov. 1965 101 p refs
(Contract AT(29-1)-789)
(SC-RR-65-502) CFSTI: HC $5.00/MF $1.00

Systems, techniques, and components for magnetic data handling, magnetic logic operations, and magnetic analog and digital storage are surveyed. 74 references. NSA

N66-29793# Stanford Research Inst., Menlo Park, Calif.
GRAPHICAL-DATA-PROCESSING RESEARCH STUDY AND EXPERIMENTAL INVESTIGATION Final Report, 1 Jun. 1963-31 Jan. 1966
A. E. Brain and J. H. Munson Apr. 1966 96 p refs *Its* Rept.-22
(Contract DA-36-039-AMC-03247(E))
(ECOM-03247-F; AD-632563) CFSTI: HC $3.00/MF $0.75

The design and operation of MINOS II are briefly summarized, including the built-in algorithms, the method of weight-changing, and the use of snake-in-the-box codes for treating analog parameters. The design of a 1024 image optical preprocessor is discussed in the light of its development from the 100-image preprocessor. An SDS-910 computer was installed to supervise MINOS II; when the ultimate objective of this project is reached, the pattern-recognition equipment will be fully integrated into a data-storage and retrieval complex, and this was the first step toward that goal. A discussion is given of the experimental results starting from the early hand-drawn map symbol experiments with the 100-image preprocessor. Corresponding experiments were carried out with the 1024-image preprocessor using edge-detector masks occupying 8% of the retinal field, as compared with 50% masks in the earlier equipment. A selective-attention experiment is described in detail. This isolated approximately ten map symbols appearing in the field simultaneously, in a manner which would permit them to be correctly categorized if the appropriate pattern-recognition function were provided. Author (TAB)

N66-29802# Texas Univ., Austin. Linguistics Research Center.

RETRIEVAL SYSTEM EXPERIMENTATION AND EVALUATION AT LRC

A. G. Dale Dec. 1965 17 p refs

(Grant NSF GN-308)

(LRC-65-WT-2; AD-627791) CFSTI: HC $1.00/MF $0.50

A time-shared experimental document retrieval system under development at The University of Texas is briefly described. A method of evaluating the effect on retrieval performance of controlled changes in the retrieval processor is proposed. (Presented at the NATO Advanced Study Institute on Evaluation of Information Retrieval Systems, The Hague, July 12–23, 1965). Author (TAB)

N66-29810# California Univ., Berkeley. Operations Research Center.

LARGE-SCALE SYSTEM OPTIMIZATION: A REVIEW

George B. Dantzig Mar. 1965 14 p refs

(Contracts Nonr-222(83); Nonr-3656(02))

(ORC-65-9; AD-619878) CFSTI: HC $1.00/MF $0.50

Possibilities are outlined that are believed to be of assistance in developing solution techniques for solving large-scale systems, the development of which will govern the cleverness used in instructing automated devices, the cleverness, in turn, determining the quality of the decisions made by the devices. The possibilities for developing the solution techniques include (1) taking advantage of the low density of nonzero coefficients in an original matrix, (2) finding a compact inverse representation of the basis using a simplex method, and (3) making use of the generalized linear program or decomposotion principle approach. The last-mentioned technique is used for illustration on a linear-control problem where it led to the maximum principle and could be used to converge constructively to an optimal solution. TAB

N66-29854# Washington Univ., Seattle. Dept. of Electrical Engineering.

MACHINE LEARNING FOR GENERAL PROBLEM SOLVING, 1964–1965

David L. Johnson Apr. 1966 95 p refs

(Grant AF-AFOSR-939-65)

(AFOSR-66-0835; AD-632576) CFSTI: HC $3.00/MF $0.75

Part I describes progress in research relevant to problem solving and learning using trigonometric identities and logical equations. The work previously described (AD-608 544) dealing with trigonometric proof learning has been analyzed and extended with the general solution and learning approach applied to proofs of logical equations. Also included is a brief description of work which investigates concept formation modeled in one sense after the work of Piaget. Part II relates the research in tree pruning as related to computers and game playing. Recent work has emphasized learning processes independent of scoring functions. Comparison is made between human play and machine play in specific game environments. Part II of the report describes evaluation of the research goal of extending the problem solving and learning processes into the field of integral calculus. It was determined, after considerable experimentation and research, that more useful research expenditure could be made in investigations of other learning areas. Author (TAB)

N66-29858# Illinois Univ., Urbana. Coordinated Science Lab.

A NOTE ON COMPUTING TIME FOR RECOGNITION OF LANGUAGES GENERATED BY LINEAR GRAMMARS

Tadao Kasami Apr. 1966 13 p refs

(Contract DA-28-043-AMC-00073(E); Grant NSF GK-690)

(R-287; AD-632569) CFSTI: HC $1.00/MF $0.50

It is shown that: (1) There exists a language L_0 which is generated by a linear grammar and is not T_n-recognizable by any on-line multi-tape turing machine if $\lim_{n\to\infty} T(n)/(n/\log n)^2=0$ and (2) any language generated by a linear grammar is n^2-recognizable by an on-line single-tape turing machine in the sense of Hartmanis and Stearns (Computational Complexity of Recursive Sequences, Proc. The Fifth Annual Symp. of Switching Circuit Theory and Logical Design, p 83–90 (1964)). Author (TAB)

N66-29865# RAND Corp., Santa Monica, Calif.

DEVELOPMENT OF NEW DIGITAL SIMULATION LANGUAGES

Philip J. Kiviat Apr. 1966 22 p refs Submitted for Publication

(P-3348; AD-631961) CFSTI: HC $1.00/MF $0.50

Theories of simulation modelling and programming are discussed, and the design aims and a few of the language statements of SIMSCRIP II, a second generation simulation programming language, are described. The probable future for simulation languages and simulation programming is postulated. TAB

N66-29872# Joint Publications Research Service, Washington, D. C.

A METHOD OF FEEDING PHYSIOLOGICAL DATA INTO THE URAL-2 ELECTRONIC COMPUTER

V. A. Nazarov 30 Jun. 1966 12 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), no. 1, 1966 p 95–98

(JPRS-36280; TT-66-32713) CFSTI: $1.00

Details of a method developed for continuous input of a large volume of physiological information into a Ural-2 electronic digital computer (EDC) are given. Recording of data in binary form is achieved on one path of magnetic tape with the aid of a multi-input analyzer. The analyzer contains a marker selector used for separation of codes of numbers and control signals. The maximum number of analyzed signals can be increased through a greater density of recording, increase in

tape drawing speed, and change of commutation time. Operation, input difficulties, and shortcomings of the Ural-2 EDC system are briefly described. The possibility of using the analyzer for simultaneous analysis of many electrograms is pointed out. S.P.

N66-29824# Bell Aerosystems Co., Buffalo, N. Y.
AERO-SPACE ENVIRONMENT SIMULATION SYSTEM (ASESS). VOLUME III: PROGRAM MODIFICATION AND IMPLEMENTATION ON THE DIGITAL COMPUTER
Bedford, Mass., AFSC, Electron. Systems Div., Nov. 1964 243 p refs
(Contract AF 19(628)-4159)
(ESD-TDR-63-659, Vol. III; AD-610715) CFSTI: HC $6.00/MF $1.25

The Aero-Space Environment Simulation System (ASESS) is a digital computer program which simulates the motion of an array of earth orbiting vehicles, both active and passive, cooperative and uncooperative, and their interactions with the environment of ground tracking, telemetry, and communications stations supporting their missions. An operational FORTRAN IV computer program presently exists for the ASESS monitor and radar subsystem. The program is applicable to the IBM 7000 series computers (as well as other computer hardware which makes the FORTRAN IV language available) and allows simulation of satellite motion and the activities of search and tracking radars, both as a function of time. The ASESS program includes the capability for historical output of simulation data via 'SNAP-SHOT', a capsule view output technique developed during the program check-out. In addition, a post-mortem plot capability has been built in to augment normal printed output data. Author (TAB)

N66-29830# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCHEME OF REMULTIPLICATION ARRANGEMENT USING THE MEASURING METHOD OF INSTANTANEOUS VALUES OF MAGNITUDES
I. M. Vitenberg and A. I. Kozlova 30 Mar. 1966 12 p refs
Transl. into ENGLISH from Vopr. Vychislitel'noy Mat. i Vychislitel'noy Tekhn. (Moscow), 1963 p 331-335
(FTD-TT-65-1493/1+2+4; AD-631853) CFSTI: HC $1.00/MF $0.50

A method is described for measuring the instantaneous value of saw-like voltages, in which the inclination angle of the linear section is proportional to the value of one of the co-factors. To exclude errors connected with small constant measuring time, the growth of linearly increasing voltage is discontinued at the measuring moment, and the magnitude of the measured voltage remains constant to the moment of fault. Operational details are given, and system schematics are included. Advantages of the remultiplication scheme are listed as: (1) The error does not exceed 1% of the maximum value, and its frequency characteristic is linear to 50 to 60 c. (2) The scheme permits remultiplication of any given input voltage into a value given in the form of pulse duration on a proper section of the magnetic drum in an analogous mathematical machine (AMM). (3) It can also be used in the construction of an AMM in which a switching over of elemental work in time is provided. M.G.J.

N66-29866*# National Aeronautics and Space Administration, Washington, D. C.
FORECASTS AND APPRAISALS FOR MANAGEMENT EVALUATION, VOLUME I
[1965] 229 p refs
(NASA-SP-6009, Vol. I) CFSTI: HC $3.75/MF $1.25 CSCL 09B

Forecasts and Appraisals for Management Evaluation (FAME), an operations research system concerned with applying scientific methods to problems facing management, is described. Forecasting concepts and utilization of a general data-handling system with particular application to weight/performance control are presented to assist managers and contractors on the Apollo Program. Techniques are applied to the weight/performance control of spacecraft, launch vehicles, and respective functional systems. Exhibits of work sheets, printouts, and reporting forms to management accompany the discussion. The design requirements, executive routine, and operation of the FAME computational system are examined. Types of information and methods of transmitting data to management are illustrated by charts and graphs. Application of FAME to areas such as cost, schedule, vehicle performance, and electrical power surveillance is pointed out. S.P.

N66-29867*# National Aeronautics and Space Administration, Washington, D. C.
FORECASTS AND APPRAISALS FOR MANAGEMENT EVALUATION, VOLUME 2
[1966] 405 p
(NASA-SP-6009, Vol. 2) CFSTI: HC $4.50/MF $2.25 CSCL 09B

A forecasting methodology is proposed for utilization in the control of space vehicle weight and performance throughout the Apollo Program. Control values for vehicle weights and payload capabilities are established. The importance of calculating probable error values is emphasized in the selection of mathematical models, because of their use as indexes of the prediction accuracy and their value in forecasting launch vehicle capability dispersion and space weight tolerance at ship date. Exponential, logistics, and adaptive exponential mathematical models are described in detail. The impulse velocity rocket equation is used to determine trade-off factors and effect of vehicle perturbations on stage dry weight, propellant loading, and specific impulse. The accompanying user's guide describes and explains how to use the computer programs comprising the Mark II computational system. Pictorial representations of the output tape, flow charts, and a computer program listing are presented. S.P.

N66-29885# Joint Publications Research Service, Washington, D. C.
THE APPLICATION OF A DIGITAL COMPUTER FOR APPROXIMATION OF DISCRETE FIELDS
V. A. Rozhkov and V. N. Vasil'yev 29 Jun. 1966 22 p refs
Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 86, 1965 p 112-123
(JPRS-36255; TT-66-32688) CFSTI: $1.00

The various possible approaches to the construction of a generalized polynomial for approximating a given discrete field are discussed. An operator scheme is described and recommendations are presented for the solution of the terms of the polynomial. An application of the method to hydrometeorology, with the use of digital computers, is given as an example. D.T.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-28453*# Northeastern Univ., Boston, Mass. Electronics Research Lab.
RELIABLE SOLID-STATE CIRCUITS Semiannual Report No. 2, Jun. 1–Nov. 30, 1965
Ralph E. Bach, Jr., A. William Carlson, Gordon F. Currin, and Charles A. Furciniti 1 Jan. 1966 82 p refs
(Grant NGR-22-011-007)
(NASA-CR-75724) CFSTI: HC $3.00/MF $0.75 CSCL 09C

An approach to the design of a pulse width modulator is presented. Although particular circuits are discussed, it is emphasized that the methods are applicable to a variety of circuits and devices having open circuit stable negative resistance characteristics. The design of a pulse power stage to best utilize the advantages of a switching amplifier is discussed, and a description of an audio power-amplifier application is provided. The circuits presented were designed to meet the requirements of microminiaturization. Additionally, a summary is provided of the research conducted in the area of reliability theory, with emphasis on an analytical formulation of reliability improvement through specific redundant configurations. The conclusions drawn from these investigations are discussed, and the promise for technological utilization of these devices in the space age is assessed.
H.S.W.

N66-28550# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
VHF-UHF Y CIRCULATORS Technical Monograph No. 6
Yoshihiro Konishi May 1965 49 p refs

A design method was established in which the optimum size of ferrite for minimum insertion loss was prescribed. A circulator with 0.3~0.5dB loss in the 100 Mc band, which could be used in transmitting equipment, was realized. In the vhf and uhf bands the optimum size enlarges in inverse proportion to the frequency. Furthermore, as applicable to receivers, a lumped element Y circulator with a mesh mechanism of inner conductor was developed and the bandwidth increased to 40–50%. The experiments were made in the range of 10 Mc–1000 Mc. Also, a circulator with an insertion loss of approximately 0.5 dB has been also developed for parametric amplifiers. It is also shown that the distributed coupling system could be realized theoretically as a 4-port circulator. As a circulator for low power, a new type circulator is proposed with small ferrite disks into which many capacitors are inserted to make the Faraday rotation enough to make a circulator. A circulator for 150 Mc with ferrite disks of 4 cm in diameter and an insertion loss of approximately 0.5dB can be made.
Author

N66-28581# Radio Corp. of America, Princeton, N. J.
MOS INTEGRATED LOGIC NETWORKS
A. K. Rapp *In* RCA, Camden, N. J. Computer Progr. [1965] p 49–51 (See N66-28586 16-08)

The properties and terminology of metal oxide semiconductors (MOS) pertinent to integrated circuits are briefly reviewed and their applications in digital data-processing systems are discussed. If the semiconducting channel of the MOS transistor is doped slightly n-type, source-drain conduction exists with zero gate-source voltage; this type of behavior characterizes the depletion transistor. If the channel is slightly p-type or intrinsic, then no drainage conduction can occur until the gate is positive driven; this enhancement transistor finds wide application in construction of logic circuits. A basic MOS transistor switch is illustrated that has a delayed-conduction threshold of several volts and can be implemented for nor and nand functions. Several examples of integrated systems employing MOS transistor arrays are also shown.
G.G.

N66-28586# Radio Corp. of America, Needham, Mass.
DESIGN AND FABRICATION OF A MONOLITHIC-FERRITE INTEGRATED MEMORY
J. J. Cosgrove, A. J. Erikson, and P. D. Lawrence *In* RCA, Camden, N. J. Computer Progr. [1965] p 76–80 refs (See N66-28586 16-08)

The developmental memory described herein utilizes integrated arrays of magnetic storage elements instead of the presently common approach of wired ferrite cores. Such an integrated memory promises lower memory-system costs for future computers, and the advantage of having the magnetic storage element operate at the power levels of the integrated-circuit logic of the new generation of data processors. In this product-development extension of the continuing research on monolithic (or laminated) ferrite memories of the RCA Laboratories, the ECD Memory Products Department in Needham, Mass. has designed an integrated memory stack of 1,024 words of 64 bits, with a built-in word-selection matrix. Words and word lengths can be varied considerably. Described is the preparation and properties of monolithic ferrite arrays and the construction of memory modules. Active product-development continues to improve wafer performance, expand range of operation, and establish techniques for large scale manufacture.
Author

N66-28731# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.
SECOND BREAKDOWN AND CRYSTALLOGRAPHIC DEFECTS IN TRANSISTORS
In its Semi Cond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 18 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

X-ray transmission topographs were used to study the possible influence of crystallographic defects on second breakdown in nearly defect-free silicon wafers with over 750 epitaxial planar open-base n-p-n transistors diffused on each of them; one wafer was gold doped before fabrication. Excess diffraction intensity along the boundaries of windows made in silicon dioxide during fabrication were the results of plastic strains produced at the interface of the diffused and the undiffused silicon lattice. Excess diffraction intensity inside the device area was caused by dislocation networks or precipitation, or both. Gold-doped wafer topography did not show a faulted emitter structure, but revealed gold precipitation and regions of non-homogeneous gold diffusion. Electrical measurements localized the gold inhomogeneities within 20 microns from the gold diffusion side; thus, the defects did not affect the active regions of the gold doped transistor. Transistor delay time histograms showed that transistors with smaller area, and thus higher thermal resistance, had a shorter delay time and were more susceptible to second breakdown.
G.G.

N66-28859# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

COMBINED START AND CROWBAR SPARKGAP WITH WIDE OPERATING RANGE

H. Haeglsperger, G. Klement, R. C. Kunze, and G. Mueller Apr. 1966 35 p refs Presented at the 4th Symp. on Eng. Probl. in Thermonucl. Res., Rome, 23-27 May 1966
(IPP-4/28) CFSTI: HC $2.00/MF $0.50

A sparkgap and its triggering mode are described having an operating range of 1:5 with a jitter of mainly less than 20 nsec within the range. The gap ratio and the electrode geometry relative to earth are unsymmetrical. Using these principles the development and characteristics of an open, normal pressure coaxial and a pressurized, parallel plate transmission line start and crowbar switch unit of small dimensions are reported. In both cases the crowbar gap is of the ferrite decoupled type. Also the start and crowbar gaps are molded together in a chamber formed by an epoxy resin insulation. Experience in operation, life test data and development will be given. Author

N66-28930# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

A 100-MHz PRESCALER IN BIQUINARY TUNNEL DIODE TRANSISTOR MODE [EIN 100 MHZ-VORUNTERSETZER IN BIQUINAERER TUNNELDIODEN-TRANSISTORSCHALTUNG]

H. Nentwich Dec. 1965 23 p refs In GERMAN; ENGLISH summary
(DESY-65/17)

A 100 MHz decimal prescaler is described which operates in the bi-quinary mode with a tunnel-diode flip-flop and a five-stage ring counter. The pulse pair resolution is better than 10 nsec. The unit has gate signal input, reset and optical readout. Author (NSA)

N66-28931# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

AN IMPROVED METHOD OF ROSSI OSCILLATOR-OSCILLOSCOPE COUPLING

W. L. Logan and G. P. Martin 20 Aug. 1965 47 p
(Contract AT(29-1)-1183)
(EGG-1183-1156) CFSTI: HC $2.00/MF $0.50

Methods of exciting the forward deflection plates of EG and G Type 3343 and 3445 oscilloscopes are analyzed, and improved methods are proposed. An analysis of line loss for reactive oscilloscope loads as a function of cable length and oscillator frequency is given. An alternate technique is then analyzed on the basis of matching the oscilloscope load to a 52-ohm transmission. The results of attempts to define the equivalent circuit between the driving points and the forward capacitance are presented. A method of implementation of matched-line feed is described. NSA

N66-28999# Central Lab. for Radiological Protection, Warsaw (Poland).

CONSIDERATIONS ON THE OPTIMALIZATION OF F.E.T. SPECTROMETER STAGES WORKING WITH SEMICONDUCTOR RADIATION DETECTOR [OPTYMALIZACJA SPEKTROMETRYCZNYCH STOPNI WEJSCIOWYCH NA TRANZYSTORACH TYPU F.E.T. WSPOLPRACUJACYCH Z POLPRZEWODNIKOWYMI DETEKTORAMI PROMIENIOWANIA JADROWEGO]

1965 21 p refs In POLISH; ENGLISH summary
(CLOR-44/D)

Some problems in the design of low-noise preamplifiers for use with solid-state detectors are discussed, and the performance and optimization of some amplifier-detector combinations are described. Some experimental results on preamplifiers using specific transistors are included. NSA

N66-29026# California Univ., Livermore. Lawrence Radiation Lab.

A PHOTOTUBE USING A SEMICONDUCTOR DIODE AS THE MULTIPLIER ELEMENT

Ralph Kalibjian 4 Feb. 1966 16 p refs Presented at 10th Scintillation and Semiconductor Counter Symp. Washington, D. C., 2-4 Mar. 1966
(Contract W-7405-ENG-48)
(UCRL-14445; CONF-660304-4) CFSTI: HC $1.00/MF $0.50

A phototube was developed with a semiconductor diode as the multiplier element. The tube has an electron gain of 1200 at 5 keV and has a linear output current in the 6-amp range with a dynamic range between 10^7 and 10^8. A description is given of the fabrication of the shallow-diffused p-n junction diodes and their use in sealed envelopes with a cesium-antimonide photocathode. Also included is a discussion of the electrostatic lens for focusing the photoelectron beam to the window of the diode, and of the overall operation of the tube. Author (NSA)

N66-29048# David Sarnoff Research Center, Princeton, N. J.

PHOTOMULTIPLIER INVESTIGATION Fifth Quarterly Report, 15 Nov. 1965-14 Feb. 1966

H. M. Smith, Jr. 21 Feb. 1966 22 p
(Contract AT(30-1)-3421)
(NYO-3421-6) CFSTI: HC $2.00/MF $0.50

Two problems often encountered by users of photomultiplier tubes today are those of dark pulses and gain shift with count rate or short term stability. Recent investigations of these problems are presented. Results from the study of afterpulses from single electrons are indicative of a correlation between afterpulses and the larger type B pulses (a correlation which originally seemed not to exist). Since afterpulses from single electrons are larger than single electron pulses, an explanation based on ions feeding back to the cathode requires that each ion generate more than one secondary electron. It was also found that type B pulses are not induced by high single electron count rates in insulatorless tubes where there are no type B pulses to begin with. Author (NSA)

N66-29071*# Associated Testing Labs., Inc., Wayne, N. J. Fifth Dimension, Inc., Princeton, N. J.

REPORT OF TEST ON MULTICODER ENVIRONMENTAL TESTS

J. Mc Gall 21 Jan. 1966 48 p Prepared for Fifth Dimension Inc.
(Contract NAS9-4590)
(NASA-CR-65406; K1178-6396) CFSTI: HC $2.00/MF $0.50 CSCL 09F

Environmental tests were conducted to determine the reaction of the microminiature multicoder to humidity, vibration, acceleration, shock, acoustic noise, oxygen atmosphere, altitude, sand and dust, and salt spray. Test procedures are detailed, and the apparatus used for each is listed. Results indicated no evidence of corrosion, deterioration, or physical damage, although the multicoder failed during the temperature and humidity cycling test. Electrical measurements

were made of the device prior to testing, and the electrical test data sheets are included. M.G.J.

N66-29073*# Fifth Dimension, Inc., Princeton, N. J.
PRE-PRODUCTION TEST PLAN, ELECTROMAGNETIC INTERFERENCE AND SUSCEPTABILITY TESTS, HIGH LEVEL MULTICODER, MODEL HDA4M-839
[1965] 71 p refs
(Contract NAS9-4590)
(NASA-CR-65409) CFSTI: HC $3.00/MF $0.50 CSCL 09C

Details are given on the test procedures to be followed in measuring the electromagnetic interference and in determining the susceptibility of the multicoder. Test objectives are defined as: (1) to determine that the levels and frequencies of conducted and radiated interference emanating from the component are within established limits; (2) to establish the susceptible conditions; and (3) to evaluate the possible degrading effects of externally generated electrical stimuli upon the unit. Test conditions are delineated, and the recommended instrumentation for performing the required measurements is listed. Sample data sheets and test set-up drawings are included. M.G.J.

N66-29074*# Fifth Dimension, Inc., Princeton, N. J.
ACCEPTANCE TEST PROCEDURE FOR FIFTH DIMENSION MULTICODER MODEL HDA4M-839
W. E. Newborn 26 Sep. 1965 71 p
(Contract NAS9-4590)
(NASA-CR-65410) CFSTI: HC $3.00/MF $0.75 CSCL 09C

The parameters covered in the electrical and environmental tests of the multicoder are listed, along with the equipment required. Test procedures are defined, and drawings of test set-ups are shown. Sample test data sheets are included. M.G.J.

N66-29080*# Radio Corp. of America, Harrison, N. J. Microwave Tube Operations Dept.
DEVELOPMENT OF A 1680-MEGACYCLE POWER OSCILLATOR Final Report, 22 May-22 Nov. 1964
O. Johnk and J. Mc Ginty [1964] 33 p
(Contract NAS1-3859)
(NASA-CR-66101) CFSTI: HC $2.00/MF $0.50 CSCL 09C

The RCA A-15497 1680 Mc power oscillator was developed as a ruggedized version of the RCA 7533 oscillator, with the same electrical characteristics. It is intended for use in the telemetering payload of a meteorological sounding rocket. The oscillator consists of a pencil triode and a tuned-plate, tuned-grid, coaxial cavity circuit. Performance testing demonstrated that device meets all electrical, mechanical, environmental, life, and reliability requirements. It was designed for low cost production in standard manufacturing facilities. In addition, its size, shape, voltage, and current are such that it can be used in the meteorological telemetering package without the package being modified in any manner. D.T.

N66-29138 Lehigh Univ., Bethlehem, Pa. Inst. of Research.
FREQUENCY CONVERSION BY THE VARIABLE CAPACITANCE OF P-I-N DIODES. THE REPRESENTATION OF MAGNETIZATION PROCESSES BY A ROTATIONAL MODEL Final Technical Report
John J. Karakash 1 Apr. 1966 43 p refs
(Grant DA-AMC-28-043-64-G7)
(AD-631636) CFSTI: HC $2.00/MF $0.50

Part I describes progress in a study of the use of the charge storage properties of the p-i-n junction diode for large signal frequency conversion. Circuits with a p-i-n diode as the active element have been constructed which can perform either frequency multiplication or division in the VHF band, and operation at frequencies up to 1 GHz appears feasible. Two theoretical studies were carried out. One was an analytical treatment of the problem of the power loss associated with charge storage in the diode, assuming the major loss mechanism to be the recovery time of carriers stored in the i-layer. The second theoretical study consisted of an analysis by digital computer of a bridge type of frequency doubling circuit. A simple charge-voltage characteristic was assumed for the diodes. Part II discusses the use of a rotational model to explain magnetization phenomena. This method of analysis is applicable to high frequency switching phenomena in magnetic materials, and is relevant to past studies of p-i-n diodes. The model yielded predictions which are in very good agreement with observed properties of magnetic materials, and it has also been found helpful in explaining complicated phenomena not readily susceptible to calculation. Author (TAB)

N66-29174# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SYNCHRONOUS MACHINE WITH SOLID ROTOR
V. M. Kutsevalov 27 Jan. 1966 235 p refs Transl. into ENGLISH of the book "Asinkhronnaya Mashina s Massivnym Rotorom" Riga, Izd. AN Latv. SSR, 1962 p 1-187
(FTD-MT-64-362; AD-631570) CFSTI: HC $6.00/MF $1.25

Contents: Equivalent circuits of asynchronous machine with solid rotor and equivalent parameters of solid rotor; Relative characteristics of an asynchronous machine with a solid rotor; Loci of currents of asynchronous machine with solid rotor; Asynchronous machine with solid rotor in regimes of asynchronous clutch and electromagnetic brake; Work of an asynchronous machine with solid rotor at connection to network through additional symmetrical resistance; Mechanical transition processes (starting /runup/, braking; reversing) of an asynchronous machine with a solid rotor; Some comparisons of characteristics and properties of asynchronous machine with solid rotor and normal asynchronous machine. TAB

N66-29219*# Hughes Aircraft Co., Culver City, Calif.
THE STUDY OF MULTIPACTOR BREAKDOWN IN SPACE ELECTRONIC SYSTEMS Final Report
Washington, NASA, Jul. 1966 119 p refs
(Contract NAS5-3916)
(NASA-CR-448) CFSTI: HC $4.00/MF $0.75 CSCL 09C

The multipactor effect, i.e., high frequency secondary emission electron resonance, was theoretically and experimentally investigated in detail in order to determine the conditions and causes of multipactor breakdown, the deleterious effects of the discharge, and methods of preventing its occurrence. The investigation is primarily intended to provide information for the design of space electronic systems and equipment, with particular emphasis on high frequency transmitters. D.T.

N66-29233# Watkins-Johnson Co., Palo Alto, Calif.
STUDY OF DISTORTION IN KLYSTRONS AND TRAVELING-WAVE TUBES Final Report, 1 Jun. 1963-31 May 1966
William Kunz Apr. 1966 69 p ref
(Contract DA-36-039-AMC-02321(E))
(ECOM-02321-F; AD-632133) CFSTI: HC $1.10/MF $0.50

This report describes the work accomplished during the eighth quarter of this study of distortion in klystrons and traveling wave tubes. In addition, it contains a detailed summary of the significant findings of the study over its completed span. Experimental results are presented indicating that no significant variation in distortion under two-tone saturated drive is found over an extremely wide selection of operating parameters in conventional traveling wave tubes. A severed helix tube design, however, did show significant performance improvement in regard to distortion suppression. Possible future avenues of approach to the distortion problem in the light of these findings are discussed. Author (TAB)

N66-29239# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.

PRODUCTION ENGINEERING MEASURE (PEM) FOR TRANSISTOR, PNP, SILICON, SWITCHING TYPE EL-2N(X-12) Third Quarterly Report, 25 Sep.–25 Dec. 1965

Larry Lands Mar. 1966 157 p refs *Its* Rept.-3

(Contract DA-36-039-AMC-06160(E))

(Rept.-03-66-28; AD-632363) CFSTI: HC $5.00/MF $1.00

The third engineering samples exhibited significant improvement in current gain performance and cutoff frequency over previous samples. Typical performance of h_{FE} at V_{CE}= 0.5 V and I_C=10 mA was in the 45–50 range (specification minimum=30). $|h_{fe}|$ performance was greater than 20 dB in most cases. The test conditions for $|h_{fe}|$ was modified from I_C=10 mA to I_C=2 mA, which allowed the measurement to be made near the peak operation point of the device. Units were fabricated on very thin, low resistivity epitaxial films. The material produced a $V_{CE(sat)}$ distribution between 0.17 and 0.25 V. Breakdowns were marginal and in many cases were governed by "punch through" considerations and not avalanche effects. Switching times were about the same for delay time and storage time; however, the increased h_{FE} and $|h_{fe}|$ produced a rise time of 4.6 ns and a fall time of 4.8 ns. A large group of units were processed and the data analyzed by an IBM 1440 computer. Parameter variation curves with bias and temperature were plotted from this data and furnish an accurate picture of the device capabilities. Preliminary reliability tests were conducted and indicated a problem area with storage life samples. Author (TAB)

N66-29244# Army Electronics Labs., Fort Monmouth, N. J. Electronic Components Lab.

TUNABLE, HIGH-POWER FERRITE FREQUENCY DOUBLER

Maurice Weiner Apr. 1966 43 p

(ECOM-2692; AD-631842) CFSTI: HC $2.00/MF $0.50

This report describes the development of a high efficiency, tunable ferrite frequency doubler operating at 17.0 GHz. The optimum efficiencies are 30% to 40% with incident power levels up to 10 kw peak, 3.0 watts average. The doubler consists of a yttrium–iron garnet (YIG) disc located at the junction of X- and K_u-band rectangular waveguides. Attempts to scale the doubler into the millimeter range are in progress. Author (TAB)

N66-29283*# Naval Ammunition Depot, Crane, Ind.

LIFE CYCLE TESTS Monthly Progress Report, 31 May 1966

[1966] 185 p

(NASA Order W-11252-B)

(NASA-CR-75826) CFSTI: HC $5.00/MF $1.25 CSCL 09A

Test data sheets are presented on the life cycle tests conducted on nickel cadmium, and silver cadmium 5- and 10-cell packs. Test parameters are listed, and cumulative failure analyses results are given. M.G.J.

N66-29304*# Bell and Howell Research Center, Pasadena, Calif.

A STUDY OF THE INTRODUCTION OF IONS INTO THE REGION OF STRONG FIELDS WITHIN A QUADRUPOLE MASS SPECTROMETER Third Quarterly Progress Report, 17 Feb.–17 May 1966

Wilson M. Brubaker [1966] 36 p refs

(Contract NASw-1298)

(NASA-CR-75843) CFSTI: HC $2.00/MF $0.50 CSCL 20F

This project is a theoretical and experimental study of the introduction of ions into the strong fields of a quadrupole mass filter. Experimental studies included the use of a new stainless steel rod quadrupole in place of the ceramic rod instrument used earlier. This new quadrupole resulted in reproducible performance. Alteration of the ratio of the dc to the ac fields in the entrance region increased transmitted ion currents by factors of ten to one hundred without sacrifice in resolving power. The design of a quadrupole system with hyperbolic instead of round rods is nearly completed. The digital computer analysis of the degradation in performance which results from the design compromise of using round instead of hyperbolic rods has been partially completed and is described to date. Author

N66-29418*# National Aeronautics and Space Administration, Washington, D. C.

A SYSTEM OF SERIES CONNECTED PHOTOELECTRIC CELLS [ANORDNUNG ZUR REIHENSCHALTUNG VON LICHTELEKTRISCHEN ZELLEN]

Erwin Falkenthal May 1963 5 p Transl. into ENGLISH of German Patent No. 655927, Jan. 1938

(NASA-TT-F-8437) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Described is an arrangement of photoelectric cells, each having a layer of light sensitive material to be exposed through a cover electrode, characterized by the fact that: (1) the superposition of cover and support electrodes of neighboring cells is limited to small parts of the cell areas, such that on the one hand the electrical connection of neighboring cells is easily made; on the other hand, a sufficient exposure of each cell is ensured on that part of its cover layer which remains free; (2) disk-shaped, individual cells are superimposed in shingle fashion; (3) disk-shaped, or annular cells, which are stacked in a known fashion on a pin are beveled in such a way that surface-exposed edge zones are created on the cover layers; and (4) the stacked disk-shaped cells have their diameters step-shaped. N.E.A.

N66-29446*# Livingston Electronic Corp., Montgomeryville, Pa.

DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES 200 WATT HOURS PER POUND TOTAL BATTERY WEIGHT MINIMUM Final Report, 10 Jun. 1964–9 Jun. 1965

Sandors G. Abens, Tyler X. Mahy, William Merz, and William F. Meyers [1966] 110 p

(Contract NAS3-6004)

(NASA-CR-54803) CFSTI: HC $4.00/MF $0.75 CSCL 10C

Studies of electrolyte solutions, electrode reactants and construction, cell manufacture, and discharge properties were conducted toward the development of high energy density, lithium-anode primary cells. Propylene carbonate showed least attack on metallic lithium among the solvents studied. Methyl formate formed the most conductive solution with $LiClO_4$ (2.6×10^{-2} ohm^{-1} cm^{-1} at 25 grams/100 ml). In cell tests, copper fluoride was the best cathode material; with propylene carbonate, active material utilization was in excess

of 80 percent at 0.5 mA/cm^2. Thirty CuF_2-Li prototype cells of ca. 4 AH capacity were built and discharged. A group of five cells having propylene carbonate-$LiClO_4$ electrolyte and discharging at 0.5 mA/cm^2 (ca. 250-hour rate) averaged in excess of 200 watt hours per pound of cell weight (including polyethylene cell case). The highest energy density for an individual cell was 522 watt hours per pound of active material weight and 223 watt hours per pound of total cell weight. Author

N66-29457*# Research Triangle Inst., Durham, N. C.
SILICON NEEDLE TRANSDUCER
R. R. Stockard and J. J. Wortman [1966] 11 p refs Presented at 1966 Intern. Solid-State Circuits Conf., Philadelphia (Contract NASr-222)
(NASA-CR-74474) CFSTI: HC $1.00/MF $0.50 CSCL 09A

The problems involved in fabricating practical transducers based on the piezojunction effect are reviewed, and the major difficulty is identified as the application of the required stress to the proper position on the semiconductor. As a solution, the semiconductor needle transducer approach was considered as a method of utilizing the piezojunction effect. This is an inversion of the indentor point method, with the point made of silicon and the p–n junction device formed on its apex. Stress was applied to the junction by forcing the needle onto a hard, conductive surface. The needles were formed by electroetching one end of a rectangular silicon bar. The p–n junctions were formed on the needle by conventional photolithographic and diffusion techniques. Both mesa and planar types were made; however, the planar types had oxide passivated junctions and were inherently more stable. In order to demonstrate its practicality, the silicon needle transducer was incorporated into a laboratory accelerometer and tested. The major advantages were found to be elimination of critical alignment problems and higher sensitivity to stress. L.E.W.

N66-29503# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
A 100 KV LOW INDUCTANCE SWITCH (SPARK GAP) FOR STARTING DIVERTING AND CLAMPING CAPACITOR DISCHARGES
A. E. Bishop and G. D. Edmonds Aug. 1965 48 p refs (CLM-P81)

The paper describes the recent development of an accurately triggered (±5 nsec) spark gap of the field distortion type operating in the swinging cascade mode up to 100 kV. Developed initially as a switch for starting a high frequency (250 kc/s) capacitor discharge it has also been adapted for diverting and clamping such discharges at current up to 200 kA, and passing up to 20 coulombs per discharge. The field distortion switch is seen as a versatile switch-type capable of extensive development. Author

N66-29534# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
LOGARITHMIC DC-AMPLIFIER WITH EARTH-ISOLATED INPUT
F. Skerjanc Apr. 1966 16 p
(IPP-4/36) CFSTI: HC $1.00/MF $0.50

In order to observe the current of an earth-isolated double-probe on the plasma-column, an intermediate stage amplifier was built which enabled the survey of dc-current in the range of 10^{-5} and 10^{-9} A in logarithmic scale on a grounded oscilloscope. The earth-isolation of the measuring probe is guaranteed with $R=10^{12}\Omega$, C=15 pf. This amplifier also can be adapted for other linear measurements on objects which ask for a potential separation towards the grounded oscilloscope. Author

N66-29605# Warnecke Electron Tubes, Inc., Des Plaines, Ill.
RESEARCH AND DEVELOPMENT PROGRAM FOR X-BAND CROSSED-FIELD AMPLIFIER Quarterly Engineering Report, 13 Dec. 1964–12 Mar. 1965
[1965] 49 p refs
(Contract NObsr-89504)
(AD-615554) CFSTI: HC $2.00/MF $0.50

The problem of bending on the delay line substrate under the combined forces of the coolant and vacuum was greatly alleviated and perhaps solved by narrowing it 25%. The alternate solution tried, a supporting member behind it, was less satisfactory. The input and output coupling was studied with the thought of suppressing the fast TEM wave between sole and line. Quarter-wave chokes are being investigated. Output and input matching need further improvement. Window design appears satisfactory. Preliminary studies of the beryllia ceramic substrate appear encouraging, but further improvement of the surface is required. The gun was shielded further because of its sensitivity to RF energy. Tests of guns alone indicate that for good enough transmission, the magnetic field must be increased, leading to too low a value of beam velocity. The brazing of the substrate to the water jacket has shown improvement, and several sub-assemblies were brazed successfully, both sapphire and beryllia. An amplifier tube is in the final stages of construction. Author (TAB)

N66-29683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS IN DESIGNING PRINTED CIRCUITS FOR SPACE
Donald H. Hardy Washington, NASA, 1966 15 p refs
(NASA-TM-X-52217) CFSTI: HC $1.00/MF $0.50 CSCL 09A

The principal requirements that must be considered in designing printed circuits are delineated in this design guide. Design parameters are covered including: conductor widths, spacing, and electronic layout considerations. Additionally, a step-by-step guide for producing a space flight printed circuit board is provided. H.S.W.

N66-29694# Piezo Technology, Inc., Orlando, Fla.
PEM FOR FILTERS, UPPER SIDEBAND (1.75 Mc) QUARTZ CRYSTAL TYPE EL-FR(X-1) Quarterly Progress Report, 1 Apr.–30 Dec. 1965
K. W. Callahan and W. H. Horton [1965] 22 p
(Contract DA-36-039-AMC-03636(E))
(QPR-4; AD-632421) CFSTI: HC $1.00/MF $0.50

Pre-production crystal filters were fabricated through this period and are ready for acceptance testing. Response characteristics of these filters are discussed. Some difficulty has been encountered with spurious responses. Author (TAB)

N66-29704# Electronic Films, Inc., Burlington, Mass.
LOW-COST MICROCIRCUIT NETWORKS Final Report, 1 Jul. 1964–31 Dec. 1965
William Mac Donald [1965] 8 p
(Contract DA-28-043-AMC-00284(E))
(ECOM-00284-F; AD-632420) CFSTI: HC $3.00/MF $1.00

The first step taken was a study of the factors that effect thin film circuit density. The study has resulted in a list of

rules for microcircuit resistor network design that were used to design a differential amplifier circuit that demonstrates the degree of circuit complexity that can be achieved on a 0.310"×0.310" square wafer. This phase of the development program concluded with the fabrication of fifty differential amplifier circuits that were electrically tested and analyzed to verify the results of the circuit design study. The second step taken in the program was the fabrication of 2000 resistor boards. A cost analysis of the production run demonstrated that the per resistor cost on the 0.310×0.310 wafer can be as low as 3.75 cents per resistor. The third step was the development of two types of thin film capacitors—one containing a silicon monoxide dielectric, the second containing a photoresist dielectric. The two capacitor types were manufactured in a limited quantity (100 units). The cost per capacitor of 22 cents has been set for the 0.310" wafer size. A life test program was run on 50 resistor networks and 50 capacitor networks to demonstrate the load life capability.
Author (TAB)

N66-29758*# CBS Labs., Stamford, Conn.
THE DEVELOPMENT OF STERILIZABLE IMAGE DISSECTOR TUBES Final Report, 15 Apr. 1964–15 May 1966
Jerry Z. Karpinski 15 May 1966 65 p Prepared for JPL
(Contracts NAS7-100; JPL-950784)
(NASA-CR-76036) CFSTI: HC $3.00/MF $0.75 CSCL 09A

The development and fabrication of sterilizable, electrostatic, wide angle, 1-1/2-in. diameter image dissectors with bialkali photocathodes are discussed. A bialkali photocathode formatioon process was developed using 2-in. diameter photomultiplier tubes with 10 multiplication stages. This process was successfully adapted to the exhaust processing of image dissectors. The experimental photomultipliers were subjected to six 36-hour, 145°C thermal sterilization cycles to measure photocathode sensitivity and gain, and it was concluded that the cycling adversely affected cathode sensitivity and response uniformity. This in turn caused deterioration of the overall response uniformity in image dissectors. The effect of sterilization cycling on all other tube characteristics was felt to be negligible. The feasibility of high sensitivity thermally sterilizable image dissectors was demonstrated by one tube whose cathode substrate was exposed to an excess of antimony and potassium followed by high temperature bake prior to photocathode formation. It was hypothesized that this procedure preconditioned the substrate and limited the diffusion and combination of the cathode forming elements into or with the substrate during subsequent processing.
L.E.W.

N66-29795# Midland-Wright, Kansas City, Kans.
MODERATE PRECISION GLASS ENCLOSED CRYSTAL UNITS, CR-(XM-44)/U Quarterly Progress Report, 1 Oct.–31 Dec. 1964
Melvin Hammer 31 Dec. 1964 25 p
(Contract DA-36-039-SC-86717)
(QPR-11; AD-631402) CFSTI: HC $1.00/MF $0.50

The preproduction crystals to be fabricated from cultured quartz was delayed, because of delays encountered in obtaining cultured quartz blanks. Some tests were pre-formed to determine the angle difference between fundamental and 3rd overtone and between 3rd overtone natural quartz versus 3rd overtone cultured quartz. Crystal design sheets as used on natural quartz are being followed on the cultured quartz except for a correction on angle.
Author (TAB)

N66-29804# American Electronic Labs., Inc., Colmar, Pa.
PHASE SHIFT VARACTOR-DETECTOR DIODES First Quarterly Progress Report, 1 Jul.–30 Sep. 1965
A. W. Barnhart and F. E. Mc Donnell Jan. 1966 31 p refs
(Contract DA 28-043-AMC-01470(E))
(ECOM-01470-1; AD-631426) CFSTI: HC $2.00/MF $0.50

In order to extend the technology of phase-shift and standing-wave amplification, present components will need to be improved. A circuit theory has been developed which reveals that the power-gain–bandwidth product is proportional to the square of the capacitance versus voltage exponent. In this respect, a unity exponent diode would have a 9.5 db advantage over a graded (1/3-law) varactor. A solution has been obtained for the linear-law varactor and techniques for its fabrication are discussed. In addition three models have been developed for a package that combines the varactor and the detector.
Author (TAB)

N66-29828# Union Carbide Corp., Parma, Ohio. Kemet Dept.
RESEARCH AND DEVELOPMENT WORK ON DEVELOPMENT OF THIN ORGANIC ROLLED FILM CAPACITOR Quarterly Progress Report, 1 May–31 Jul. 1965
[1965] 26 p
(Contract NObsr-89519)
(QPR-6; AD-623905) CFSTI: HC $2.00/MF $0.50

Progress is reported on a program to improve the characteristics of parylene coated foil capacitor and to develop a metallized parylene capacitor capable of operating over the temperature range of −55°C to 125°C at a rated voltage of 100 VDC, whose capacitance volume ratio is one-half that of a 50 volt metallized Mylar capacitor. Such capacitor to exhibit a dissipation factor less than 0.25%; 250 megohm microfarad minimum insulation resistance at 125°C; temperature coefficient less than 300 ppm/°C; 200% dielectric voltage withstand; less than 5% change in capacitance after life. Topics include: parylene coated foil capacitors (improved cleanliness and smoothness of substrate foil, effects of core material and configuration, case insulation); parylene coated metallized capacitors (design considerations, capacitor web development.)
TAB

N66-29832# Weston Instruments, Inc., Newark, N. J.
A POROUS SUBSTRATE RESISTOR AIMED AT MINIATURIZATION OF METAL-FILM RESISTORS Interim Development Report, 1 Dec. 1964–28 Feb. 1965
T. Matley and R. E. Busch [1965] 43 p
(Contract NObsr-87542)
(IDR-10; AD-619824) CFSTI: HC $2.00/MF $0.50

A correlation between structural characteristics of the substrate and reproducibility of resistance values is illustrated. It is advocated that the quality of the substrate can be typified by the standard deviation in weight-to-volume ratio and the standard deviation in flow. These two parameters have been combined to give a quantitative measure of substrate uniformity by defining a structure factor. In most cases, the average % standard deviation in resistance is linearly proportional to the structure factor. In obtaining this correlation, it is necessary to consider groups defined by substrate type and method of terminating. It is thus a statistical result which cannot be applied to individual units or metallizing lots.
Author (TAB)

N66-29842# Naval Avionics Facility, Indianapolis, Ind.
THE EFFECT OF ANNEALING THIN FILM CAPACITORS
W. M. Mc Guire 27 Apr. 1965 17 p refs
(NAFI-TR-536; AD-631955) CFSTI: HC $1.00/MF $0.50

An annealing treatment upon thin film capacitors using silicon monoxide (SiO) as the dielectric will significantly increase the d-c resistance and decrease the capacitive dissipation of good thin film capacitors. However, initially inferior capacitors generally do not show improvement after annealing. Author (TAB)

N66-29845# Hughes Aircraft Co., Fullerton, Calif.
MICROMINIATURIZATION MULTIPLANE INTERCONNECTIONS First Quarterly Report, 1 Jul.-30 Sep. 1965
William T. Rhoades Fort Monmouth, N. J., Army Electron. Command, Apr. 1966 141 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01439(E))
(ECOM-01439-1; AD-632390) CFSTI: HC $4.00/MF $1.00

The purpose of this work is the development of interconnections for ultrahigh-speed-micro-circuit module arrays. Four module packaging approaches for ultra high speed circuits, along with a new packaging technique, are presented and compared. High complexity arrays are discussed and analyzed from the viewpoint of cost and performance. Progress on the subassembly and assembly and assembly designs is described. Various power requirements and delay measurements on the ultra-high-speed gate are given. Author (TAB)

N66-29860# Naval Ordnance Lab., White Oak, Md. Physics Research Dept.
A MINIATURE PULSE GENERATOR
K. G. Williams 21 Oct. 1965 16 p refs
(NOLTR-62-165; AD-632197) CFSTI: HC $1.00/MF $0.50

The circuit details and operation of a compact solid-state pulse generator are discussed. Besides its portability, the generator features a wide range of repetition rates, time delays, and pulse widths. It produces well-shaped rectangular pulses having rise and fall times of 25 nanoseconds each. Pulse delays and widths are available from 1 microsec to 1 sec with repetition rates from 0.2 to 25,000 cycles per second. Amplitude is continuously variable from zero to −10 volts. Author (TAB)

N66-29874# Joint Publications Research Service, Washington, D. C.
DEVELOPMENT TRENDS IN CATHODE RAY TECHNOLOGY
M. von Ardenne, S. Schiller, and U. Heisig 30 Jun. 1966 36 p refs Transl. into ENGLISH from Technik (Berlin), v. 21, no. 4, Apr. 1966 p 257-263; no. 5, May 1966 p 307-313
(JPRS-36263; TT-66-32696) CFSTI: 2.00

Cathode ray technological developments are reviewed, and characteristics common to all electron guns are listed. Electron beam welding installations, specifically those with high accelerating voltages up to 150 kV, and electron beam machining installations, as well as evaporating, melting and firing arrangements for electron beams are discussed in some detail. Block diagrams and schematics portray separate apparatus arrangements. Some specific topics mentioned in this literature survey are: cathode beam source, focusing and deflection systems; electron beam multi-chamber furnace; single resistors and resistor combinations from beam adjustment automaton; digital program control apparatus; deviations from the mean value for a certain vapor-depositing charge of 180 resistor combinations with two resistors; penetration depth of the electron beam for deep-welding; single beam guns as electron sources for electron beam melting furnaces; and single gun arrangement with separately evacuated, continuous-charge gun chamber. R.Ll.

N66-29876# Joint Publications Research Service, Washington, D. C.
SINGLE CRYSTAL SEMICONDUCTOR RECTIFIERS OF MEDIUM AND HIGH POWER
E. Bura 27 Jun. 1966 27 p refs Transl. into ENGLISH from Elektrie (Germany), no. 4-5, 1965 p 148-149, 181-185
(JPRS-36178; TT-66-32612) CFSTI: $1.00

Soviet-produced medium and high power silicon rectifier diodes and thyristors are described. Designation systems are given and illustrated. Technical data include classification and tabulation according to the alloy and diffusion techniques used. Tables of operating temperature range are given, and overload capacity for series and parallel construction is mentioned. The thyristors were tested, and the breakdown voltage in the reverse direction and sweep voltage at crystal temperature of 120°C were measured. Diagrams illustrate the construction and overall dimensions of the thyristors. L.E.W.

N66-29886# Lincoln Lab., Mass. Inst. of Tech., Lexington.
COOLED AND UNCOOLED VARACTORS FOR PARAMP APPLICATIONS
Frederick J. Dominick 5 Apr. 1966 28 p refs
(Contract AF 19(628)-5167)
(TN-1966-27; ESD-TDR-66-160; AD-632232) CFSTI: HC $2.00/MF $0.50

A discussion of the properties needed to obtain high-quality varactors is presented. Test data are also presented on state-of-the-art varactors as they are cooled from room temperature (290°K) to liquid helium temperature A(4.2°K).
Author (TAB)

N66-29903# Naval Avionics Facility, Indianapolis, Ind.
EVALUATION OF STANDARD ALUMINUM ELECTRODE THIN FILM CAPACITORS
W. Mc Guire 17 May 1965 16 p refs
(NAFI-TR-557; AD-632028) CFSTI: HC $1.00/MF $0.50

The report shows that the characteristics of thin film capacitors utilizing aluminum electrodes and SiO dielectrics can be improved by annealing at 450°C. Some indication is given to the effect of various process parameters during dielectric deposition and supports the general concensus that consistently good thin film capacitors are rather difficult to fabricate. Author (TAB)

N66-29919# Army Electronics Labs., Fort Monmouth, N. J.
INVESTIGATION OF NOISE IN MAGNETRON INJECTION GUNS Interim Report
Paul Fischer Mar. 1966 24 p refs
(ECOM-2690; AD-631841) CFSTI: HC $1.00/MF $0.50

A space-charge flow for the magnetron injection gun has been derived which includes the effect of a constant electric field parallel to the cathode. The analysis indicates that the introduction of such a field in a magnetron injection gun will reduce electron back-bombardment of the cathode and improve beam laminarity. Back-bombardment and nonlaminarity are deleterious to the useful operation of magnetron injection guns, which are often needed for incorporation in high-power microwave tubes. Author (TAB)

N66-29935# Cornell-Dubilier Electronics Div., Federal Pacific Electric Co., Norwood, Mass.
PRODUCTION ENGINEERING MEASURE FOR PRODUCTION OF SILICON MONOXIDE CAPACITORS Quarterly Report, Dec. 1965–28 Feb. 1966
Welville B. Nowak [1966] 16 p
(Contract DA-36-039-AMC-0147(E))
(QR-11; AD-632229) CFSTI: HC $1.00/MF $0.50

Groups A and B acceptance testing were completed for the pilot production of each type of microelement: 560, 180, 100, and 68 pf. Group C testing has been initiated. Process improvements have increased recent yields to approximately 90%. Future production problems would be re-use of the SiO source material over multiple runs, and cleaning of the Edwards quartz crystals after six or seven Al-SiO-Al cycles. Author (TAB)

N66-29940# Navy Electronics Lab., San Diego, Calif.
MICROCIRCUIT RELIABILITY PREDICTION METHODS Research Report, Jul. 1965–Feb. 1966
H. F. Dean 11 Mar. 1966 15 p ref
(NEL-1347; AD-631972) CFSTI: HC $1.00/MF $0.50

A survey of possible test methods, and some exploratory work, showed that the most promising methods for the reliability screening of microcircuits are conventional electrical tests; special electrical tests such as rf noise measurement and use of the ring-counter technique; infrared temperature measurement; and visual inspection. Author (TAB)

N66-29956# Army Electronics Labs., Fort Monmouth, N. J.
LIFE EXPECTANCY OF A NEW MINIATURE POWER RELAY
William J. Fontana Mar. 1966 56 p refs
(ECOM-2672; AD-632340) CFSTI: HC $3.00/MF $0.50

The report describes a laboratory-conducted program wherein a new miniature power relay design was subjected to a series of life tests to develop its life expectancy profile under a broad range of electrical operating conditions. The principle of factorial experimentation was applied to develop a test program which, over the relay's design range of resistive load conditions, operating temperatures, and operating rates, would provide useful data at minimum cost. From the resulting statistical analysis, a series of functional relationships between the relay life expectancy and the operating stress levels were developed. Mathematical and graphical representations of these relationships are given for use by design engineers in estimating the life expectancy, or reliability, of the relay under specific operating conditions. In addition, the curves can be used to estimate the effect which, trading off, specific operating parameters can have on the expected reliable life of the relay. Author (TAB)

N66-29964# Hughes Aircraft Co., Fullerton, Calif.
SURFACE EFFECTS OF RADIATION ON MICROELECTRONIC DEVICES Final Report, 12 Apr.–2 Nov. 1965
Daniel Binder, Barbara M. Kuehne, Ronald I. Wilbur, and Daryl T. Butcher 2 Nov. 1965 70 p refs
(Contract N228(62479)68966)
(USNRDL-TRC-19; FR-65-10-243; AD-632112) CFSTI: HC $6.60/MF $0.75

The objectives were to study: (1) the radiation susceptibility of planar transistors (separately and in integrated circuits) and insulated gate thin film transistors (IGTFT) irradiated with Co^{60} gamma radiation and linac electron radiation; (2) the relation between the radiation response and physical characteristics; (3) the radiation susceptibility in general for planar and IFTFT devices; and (4) the degree to which Co^{60} radiation can be used to investigate surface radiation effects from a weapon's burst. Author (TAB)

N66-29973*# Martin Co., Orlando, Fla.
INFRARED TESTING OF ELECTRONIC COMPONENTS Final Report, 5 Apr. 1965–5 Jun. 1966
W. R. Randle, G. Chadderdon, and T. L. Hartman, Jr. Jun. 1966 115 p
(Contract NAS8-20131)
(NASA-CR-76080; OR-8347) CFSTI: HC $4.00/MF $0.75 CSCL 09A

The feasibility of developing an infrared radiation nondestructive test technique for electrical/electronic devices was investigated. The phases included are: (1) a state-of-the-art survey of industry and government organizations, (2) testing conformal coating materials to standardize surface emissivity, and (3) determining the use of infrared in various actual applications. A relationship between infrared radiation and life expectancy was established. It was found that increased operating temperature has a deleterious effect on transistor life expectancy, but also design and process variables may have a significant effect. Infrared fingerprinting of the operating components on a printed circuit board for thermal derating analysis and for troubleshooting was proven to be feasible, and was successfully employed in: (1) locating the hotter components on a printed circuit board, (2) evaluating the effects of relocation, and (3) accurately evaluating a variety of heat sink configurations and transistor mounting techniques. The requirements for application of infrared and its limitations are identified. N.E.N.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-28428# Joint Publications Research Service, Washington, D. C.
NEWS OF THE ACADEMY OF SCIENCES USSR DEPARTMENT OF TECHNICAL SCIENCES TECHNICAL CYBERNETICS NO. 1, 1966
6 Jun. 1966 304 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, OTN, Tekhn. Kibernetika (Moscow), no. 1, Jan.-Feb. 1966 p 1–184
(JPRS-35873; TT-66-32307) CFSTI: HC $6.00

Articles on technical applications of cybernetics are presented. For individual titles see N66-28429–N66-28452.

N66-28432# Joint Publications Research Service, Washington, D. C.
OPTIMIZATION OF COMMUNICATION BETWEEN THE SECTIONS OF A CHEMICAL PLANT
A. Z. Korchinskiy, I. N. Minsker, and Ye. A. Talitskaya *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 41–56 refs (See N66-28428 16-10) CFSTI: $6.00

Chemical production is investigated with nonlinear communication, and an algorithm is proposed for optimization based on the method of dynamic programming. Author

N66-28433# Joint Publications Research Service, Washington, D. C.

THE ACCELERATION OF THE SIMULATION PROCESS WHEN EVALUATING THE EFFICIENCY AND RELIABILITY OF COMPLEX SYSTEMS BY THE METHOD OF STATISTICAL TESTS

V. M. Rakhval'skiy *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 57–63 refs (See N66-28428 16-10) CFSTI: $6.00

The methods of acceleration of the simulation process are investigated when evaluating the efficiency and reliability of complex systems. The proposed methods provide for high accuracy of calculations for allowable expenditures of machine time (on the order of several hours for high speed digital computers) when evaluating highly reliable systems. Author

N66-28434# Joint Publications Research Service, Washington, D. C.

ON EVALUATION OF THE RELIABILITY OF SEQUENTIAL SYSTEMS WITH REPAIR

O. V. Shcherbakov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 64–71 refs (See N66-28428 16-10) CFSTI: $6.00

The problem of determination of the reliability characteristics for sequential systems, the elements of which have the possibility of being repaired, is investigated. Formulae are presented for carrying out the necessary calculations. Author

N66-28435# Joint Publications Research Service, Washington, D. C.

THE DETERMINATION OF PROBABILITY AND RELIABILITY OF OPERATION OF A SYSTEM DURING A GIVEN TIME INTERVAL

V. S. Zaritskiy *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 72–78 refs (See N66-28428 16-10) CFSTI: $6.00

The problem of determination of probability that the random function u(t), the correlation function of which during the time T does not go beyond the limits which provide for normal operation of the system, is investigated. The formulae, graphs and tables are presented with the help of which it is possible to obtain an approximate solution of this problem without awkward calculations. Author

N66-28436# Joint Publications Research Service, Washington, D. C.

ON THE RELIABILITY OF LOGICAL CONTROL SYSTEMS OF THE CYCLICAL TYPE WITH PERIODIC CONTROL OF STATE OF REPAIR

A. M. Gurevich *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 79–89 refs (See N66-28428 16-10) CFSTI: $6.00

The reliability of cyclical logical control systems with a limited number of operating states is investigated. Formulae are presented for the upper and lower values of the probability of breakdown free operation of the system. Author

N66-28437# Joint Publications Research Service, Washington, D. C.

THE TRANSFER FUNCTIONS OF CONTACT RELAY SYSTEMS TAKING INTO ACCOUNT ELEMENT DISREPAIR

Yu. A. Gogin and V. V. Kudryavtsev *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 90–98 refs (See N66-28428 16-10) CFSTI: $6.00

A procedure is presented for writing the dependencies of the contact relay system outputs on the inputs and the states of the elements (the state of repair) in terms of algebra of logic. In an example the solution of one control problem for contact relay systems is illustrated. Author

N66-28438# Joint Publications Research Service, Washington, D. C.

A PROBLEM IN THE THEORY OF FINITE AUTOMATA

V. A. Moshchenskiy *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 99–112 refs (See N66-28428 16-10) CFSTI: $6.00

A method of synthesis of automata with respect to a finite number of experiments is discussed based on giving the automaton by the contiguity matrix of the graph G=(N,U) where the set N is all the tests of length l of the given automaton, and the set U of the directional arcs is defined by the transition function. Author

N66-28439# Joint Publications Research Service, Washington, D. C.

REALIZATION OF LOGICAL FUNCTIONS MADE OF ONE THRESHOLD ELEMENT

V. I. Loginov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 113–126 refs (See N66-28428 16-10) CFSTI: $6.00

The necessary conditions are given for realization of the logical function (LF) using one threshold element (PE). The problem of realization of the LF using one PE reduces to the solution of a system of linear inequalities. Procedures are proposed for reducing the redundancy of the system of inequalities obtained and the method for solving it. The application of the method is demonstrated in the examples.

Author

N66-28440# Joint Publications Research Service, Washington, D. C.

PREDICTING THE TRAJECTORIES OF STOCHASTIC SYSTEMS

Yu. I. Parayev *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 127–139 refs (See N66-28428 16-10) CFSTI: $6.00

A new solution of the R. Ye. Kalman and R. S. Bucy problem on predicting the trajectory of a stochastic dynamic system has been obtained. This solution is correct also for the case of non-white gaussian noise. A comparison is made in the example of a first order system of the solution obtained here with another solution previously obtained.

Author

N66-28442# Joint Publications Research Service, Washington, D. C.

A METHOD FOR SYNTHESIS OF A STATISTICALLY OPTIMAL SYSTEM

Yu. V. Semenov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 152–159 refs (See N66-28428 16-10) CFSTI: $6.00

The problem of selection of the parameters of a regulator in automatic control systems has acquired great significance in modern technology. There are a large number of works devoted to the developments of algorithms and individual devices, so called optimizers, which solve the problem of automatic selection of values of parameters for given values of the initial conditions and the disturbance effects on the system. In the given work a method is proposed for selection of parameters taking into account the statistical properties of the solutions of a system of differential equations describing the dynamics of the control system. The method is based on the use of the equations of set linear regression. Author

N66-28443# Joint Publications Research Service, Washington, D. C.

DESIGN OF AUTOMATIC STEP OPTIMIZERS WITH DEPENDENT SEARCH

Ye. D. Garber *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 160–172 refs (See N66-28428 16-10) CFSTI: $6.00

Among the various systems of automatic optimizers there is application of proportional step extremum regulators with separate realization of trial and operating movements (with dependent search for the extremum). The investigation of these systems in the case of a quadratic characteristic and defined forms of the linear part of the object has been carried out. It follows to note that the discreteness of the system of the indicated type permits, analogously to the case of relay extremal systems, calculation of their conditions without neglecting the higher harmonics for any order of the object. In the present work the results are presented from such an investigation. The effect of random noise is not investigated; a review of works in this area is presented. For the case of an inertialess object some results are developed. Author

N66-28444# Joint Publications Research Service, Washington, D. C.

ESTIMATION OF THE EFFECTIVENESS OF AUTOMATIC CONTROL SYSTEMS WITH SELF-ADJUSTMENT WITH RESPECT TO THE IMPUT SIGNAL

N. N. Korobov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 173–180 refs (See N66-28428 16-10) CFSTI: $6.00

The effectiveness of using self-adjustment with respect to the input signal is investigated in automatic control systems. The concept of effectiveness of the real and ideal self-adjusting systems introduced permits evaluation of the gain with self-adjustment, approximate determination of stability, and also indication of procedures for determination of the parameters of the self-adjustment circuit. Author

N66-28446# Joint Publications Research Service, Washington, D. C.

THE REALIZATION OF A PROCESS WHICH IS OPTIMAL WITH RESPECT TO HIGH SPEED IN A THIRD ORDER CONTROL SYSTEM

N. P. Lonshakov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 192–204 ref (See N66-28428 16-10) CFSTI: $6.00

The possibilities of realization of a process which is optimal with respect to high speed in an open third order control system with three limitations (with respect to the control signal at the input of the system, the speed and acceleration of the controlled coordinate) are investigated with the help of switching the relay element installed at the input of the system. The relay element may be a two- or three-position element. The calculated data are presented together with oscillograms of the processes for a generator–motor system under the control of a relay element made of thyristors. Author

N66-28447# Joint Publications Research Service, Washington, D. C.

THE VARIABILITY INDEX IN EVALUATING THE PROCESS QUALITY IN NONLINEAR SYSTEMS

I. P. Pal'Tov and V. I. Tsvetkov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 205–214 refs (See N66-28428 16-10) CFSTI: $6.00

The possibilities of using the variability index for evaluation of the quality of processes in nonlinear systems which converge in equilibrium are investigated. It is shown that the variability index may be used for evaluation of processes with any type of nonlinearities including nonlinearities which have equivalent phase-amplitude characteristics depending both on the amplitude and on the frequency of the input coordinate of the non-linear link. Author

N66-28448# Joint Publications Research Service, Washington, D. C.

CORRECTION CIRCUIT IN PULSE SYSTEMS WITH VARIABLE PARAMETERS

I. P. Devyaterikov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 215–227 refs (See N66-28428 16-10) CFSTI: $6.00

Methods of synthesis of pulse systems with variable parameters are proposed. Two types of corrections are considered: a correction in the direct circuit and a correction in the feedback circuit. Author

N66-28451# Joint Publications Research Service, Washington, D. C.

A PULSE SHAPER FOR ELECTRONIC DIGITAL DEVICES

S. A. Aleskerov and I. L. Abrosimov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 254–263 refs (See N66-28428 16-10) CFSTI: $6.00

A pulse shaper is investigated with an impact excitation circuit made of a transistor for electronic digital devices. On the basis of the analysis of the system formulae are obtained for design of the shaper and the parameters of the output pulse. Author

N66-28452# Joint Publications Research Service, Washington, D. C.

THE DEFINITION OF THE REGIONS OF ATTRACTION FOR VARIOUS CONDITIONS OF A TRISTABLE PARAMETRON

L. A. Sinitiskiy *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 264–277 refs (See N66-28428 16-10) CFSTI: $6.00

The operation of a parametron is investigated for a given excitation current of rectilinear form and an ideal curve for magnetizing the cores. The possibility of the existence of subharmonic oscillations on the order of 1/2, 1/4, 1/6, or

has been demonstrated for one and the same parameters of the element depending on the initial conditions. On the basis of the method of exact conversions the regions of the initial conditions reducing to different periodic conditions have been found. It has been demonstrated that the selection of the parameters may eliminate all the subharmonic oscillations with the exception of the 1/2 harmonic which is required for realization of a tristable parametron. Author

N66-28454*# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia).
SYNTHESIS OF IMPROVED FEEDS FOR LARGE CIRCULAR PARABOLOIDS
H. Minnett and B. Mac A. Thomas [1966] 14 p refs Presented at the Conf. on the Design and Construct. of Large Steerable Aerials, London, 6-8 Jun. 1966
(Grant NsG-240-62)
(NASA-CR-75690; RPP-1003) CFSTI: HC $1.00/MF $0.50 CSCL 09C

A technique for synthesizing high-efficiency, low-noise feeds for large circular paraboloids has been developed from a study of the focal-region fields. This has led to the concept of hybrid modes propagated inside cylindrical waveguides with anisotropic boundaries. These boundaries may be realized physically with corrugated structures. The radiation patterns of hybrid-mode feeds have inherent axial symmetry and produce zero cross-polarization at the paraboloid aperture. Radially-shaped patterns may be constructed by superimposing higher-order hybrid modes. This requires only half the number of independently-generated modes as existing synthesis techniques. Author

N66-28592# Radio Corp. of America, Camden, N. J.
REFLECTIONS IN HIGH-SPEED DIGITAL CIRCUITS
A. Feller and J. J. Di Giacomo *In its* Computer Progr. [1965] p 52-55 refs (See N66-28586 16-08)

Some aspects of transmission line reflection theory as they apply to digital computer design criteria and compromises are discussed. A method is suggested for determining whether a given interconnection between two points may be treated as a transmission line with distributed parameters or, in the more conventional manner, as a lumped element. The relationships between reflection amplitude, characteristic impedance, number of loads, spacing of loads and signal transition times are presented. Author

N66-28633*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[SOLID STATE, APPLIED ELECTROMAGNETICS AND PLASMAS, AND INFORMATION SCIENCES RESEARCH] Consolidated Semiannual Progress Report No. 3, 1 Oct. 1965-31 Mar. 1966
[1966] 147 p refs
(Grant NGR-05-018-022; Contracts AF 04(695)-746; AT(11-1)-113; Nonr-228(34); Grant DA-ARO(D)-31-124-G764 et al)
(NASA-CR-75859) CFSTI: HC $4.00/MF $1.00 CSCL 09C

A summary is presented of research in various areas of solid state physics, applied electromagnetics and plasmas, and information sciences. These studies include: electron probe analysis of semiconductors; electron transport and X-ray production in solids; ferromagnetic resonance in doped YIG crystals; nuclear magnetic resonance in ferromagnetic alloys; defect chemistry of CdS; ionic conductivity in high resistivity CdS; theory of metallic binding; superconducting thin films as microwave circuit elements; wave propagation in bounded, magnetized, hot plasmas; radiation and diffraction of electromagnetic waves; millimeter wave radiometry for radio astronomy; general theory of optimization; optimal control in rendezvous, pursuit and similar two body problems; information processing and signal design theory; coding theory and automata studies; and hybrid and digital computation. Additional research in related areas are discussed, and a bibliography of the research papers generated by these studies is included. H.S.W.

N66-28886# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
AN ANALOG SYSTEM FOR THE DESIGN OF SWITCHED DISCHARGE CIRCUITS IN PLASMA PHYSICS
G. Herppich and A. Knobloch Apr. 1966 31 p refs Presented at the 4th Symp. on Eng. Probl. in Thermonuclear Res., Frascati, Italy, 23-27 May 1966
(IPP-4/29) CFSTI: HC $2.00/MF $0.50

In designing pulse discharge circuits it is necessary to have a cheap and quick method of checking the computed data. This is afforded by the switching circuit analog system. A method was devised in which the ordinary switches, i.e. spark gaps or ignitrons of the original arrangement, are replaced by mercury-wetted contacts. These are operated by a program controlled system with special terminal amplifiers. The program controlled system enables the switches to be delayed from 0 to 1000 μsec. With the aid of the special terminal amplifiers the jitter of the relay is limited to ±300 nsec. With a linear impedance transformation the real and distributed electrical values will be transformed in such order of magnitudes that they can be easily maintained and adjusted. The model investigations are carried out mainly in original time scale. In investigating circuits with transit time effects, this approach has the advantage of allowing original components (e.g., cables or sandwich conductors) to be used. Author

N66-29176# Illinois Univ., Urbana. Coordinated Science Lab.
GENERATION OF TREES AND COMPLETE TREES
Wataru Mayeda Apr. 1966 37 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-931-65)
(R-284; AD-631691) CFSTI: HC $3.60/MF $0.50

A method of generating all complete trees of a pair of linear graphs which can represent active networks is given. This method consists of two parts, one of which is to obtain one complete tree and the other is to generate all possible complete trees of distance one from that already determined. TAB

N66-29216*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMAL CONTROL OF SATURATING SYSTEMS WITH STOCHASTIC INPUTS
Elwood C. Stewart and William P. Kavenaugh Washington, NASA, Jul. 1966 25 p refs Presented at the 3d Congr. of Intern. Federation of Autom. Control, London, Jun. 1966
(NASA-TN-D-3479) CFSTI: HC $1.00/MF $0.50 CSCL 09C

This study is concerned with the optimal control of nonlinear systems which operate in the presence of random unwanted disturbances. Although the results are intended to be applicable to a certain class of nonlinear systems, saturating systems are emphasized because of their practical importance. Such systems are important when operation occurs in critical regions, for example, in the control of vehicles in situations

where the available thrust is marginal. This report presents an approximate method of synthesizing the optimal controller with noisy measurements which utilizes the limited control function in the best possible manner. The principal results show that: (1) although there is no minimum, the performance can approach arbitrarily closely to a greatest lower bound, and (2) striking improvement in performance can be obtained in comparison with linear theory when operating in critical regions. Computer results are used for verification. In addition, dimensionless curves of the optimal performance are given as a function of a dimensionless parameter involving the input statistics and saturation value of the forcing function. Author

N66-29222*# Measurement Analysis Corp., Los Angeles, Calif.
ELECTRICAL ANALOGIES AND THE VIBRATION OF LINEAR MECHANICAL SYSTEMS
Washington, NASA, Jun. 1966 124 p refs
(Contract NAS8-20020)
(NASA-CR-510) CFSTI: HC $4.00/MF $1.00 CSCL 20C

This report is tutorial in nature and deals primarily with concepts basic to the vibration of mechanical systems and their equivalent electrical analogies. Although both mechanical impedance and operational amplifier circuits are considered, emphasis is given to passive mobility circuits for the vibration of distributed elastic structures. The single-degree-of-freedom system is used to illustrate and interrelate many of the concepts and definitions common to mechanical systems and electrical circuits. The mobility concept is then extended to include distributed physical systems described mathematically as partial differential equations. These resulting analogs are electrically equivalent to finite-difference forms of the partial differential equations and can be used directly to synthesize complete electrical models of physical systems. Difference mobility analogs are shown for the vibration of the simple beam, the Timoshenko beam, a curved beam, a rectangular shear panel, and a rectangular plate. Similar analogs are shown for problems typical to heat transfer and fluid flow. Author

N66-29260# Michigan State Univ., East Lansing. Div. of Engineering Research.
MINIMIZATION OF RADAR CROSS SECTIONS OF CYLINDERS BY COMPENSATION METHOD Scientific Report No. 1
Kun-Mu Chen 25 Feb. 1966 20 p refs
(Contract AF 19(628)-5732)
(AFCRL-66-207; AD-632132) CFSTI: HC $1.60/MF $0.50

The feasibility of minimizing the back scattering of a conducting cylinder by attaching a parallel thin, loaded wire is investigated. When the cylinder and wire are illuminated by an electromagnetic wave, currents are induced on them. If the induced current on the wire is modified by a proper impedance loading, it may cancel the effect of the induced current on the cylinder in such a way that the total back-scattered field produced by the cylinder and the wire is minimized. In the analysis, a solid cylinder and a thin, center-loaded wire are placed parallel to one another and a plane wave is assumed to be incident on them at an angle. The induced current on them and the scattered field from them are calculated, and the optimum impedance to be loaded at the wire to achieve zero total back scattering is obtained. This method could have direct application to radar camouflage for space vehicles. Author (TAB)

N66-29270# California Univ., Berkeley. Electronics Research Lab.
NOTES ON SYSTEM THEORY, VOLUME VIII
R. A. Baker et al 1 Nov. 1965 103 p refs
(Grants NSF GK-569; DA-ARO(D)-31-124-G576; AF-AFOSR-639-65; AF-AFOSR-139-65)
(ERL-65-30; AD-632067) CFSTI: HC $4.00/MF $0.75

Contents: Comments on the Stability of Linear Time-Invariant Systems with Infinite Dimensional State Spaces, by R. A. Baker; Encoding a Geometric Source, by E. R. Berlekamp; Some Comments on B1 Codes, by E. R. Berlekamp; A 'Gain' Formula for Linear Vector Flow Graphs, by R. N. Biswas; An Optimum Search Strategy for Locating the Maximum of a Unimodal Function, by T. Fine; Construction of Regular Expressions for Binary Machines, by Lionel Lecoq; La Grange Multipliers and Signal Design, by L. P. Seidman; Pattern Classification in Qubic, by I. L. Traiger; and On the Passivity of Nonlinear RLC N-Ports, by K. K. Wong. Author (TAB)

N66-29277# Army Electronics Labs., Fort Monmouth, N. J.
APPLICATION OF A PARTICULAR SOLUTION OF THE EULER-POISSON EQUATION TO TERRAIN-FOLLOWING AND FORMATION-FLIGHT AIRCRAFT SUBSYSTEMS
Norman K. Shupe Apr. 1966 19 p refs
(ECOM-2691; AD-632128) CFSTI: HC $1.60/MF $0.50

This report deals with the automatic control of an aircraft in a terrain-following mode of operation. The primary concern of the report is the generation of an analytical control law which takes into account the main constraints of aircraft performance, those of maximum lift acceleration and maximum climbdive angle capability. The approach taken is to solve the Euler-Poisson equation for a particular, but realistic, definition of an 'optimum' flight trajectory. The resulting solution of the Euler-Poission equation contains a shaping parameter which allows a good bit of freedom in shaping the basic flight path trajectory to the characteristics of a particular aircraft. The control law is such that errors in prediction of present and future aircraft dynamic performance are manifested to a minimal extent, in the accuracy of present command to the aircraft. An application of the developed control law to the analog computer simulation of an aircraft formation flight subsystem is presented as an appendix. Author (TAB)

N66-29278# Army Electronics Labs., Fort Monmouth, N. J.
DIRECT PRODUCTION OF ELECTRICAL PULSES FROM GALVANIC CELLS, II
Herbert F. Hunger, James E. Wynn, and Nunzio J. Sanfilippo Mar. 1966 27 p refs
(ECOM-2670; AD-632103) CFSTI: HC $2.00/MF $0.50

Based on half cell studies on anodic half elements showing simultaneous current and voltage oscillations, further work was done in order to transfer this oscillatory behavior into complete galvanic cells. Complete cell studies with simulated electromotively active counter electrodes permitted one to define the electrochemical requirements for a self-self-oscillating galvinc cell. Based on these guidelines an experimental cell was designed and constructed. The cell was capable of delivering pulsating current, voltage, and power instead of regular dc. The electrical and thermodynamic characteristics of the cell were analyzed. Author (TAB)

N68-29353*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ACTIVATION CRITERION FOR REPEATED USE OF AN OPTIMAL FIXED TIME CONSTANT ENERGY REGULATOR
Paul S. Rampfer [1965] 8 p refs Presented at the 12th East Coast Conf. on Aerospace and Navigational Electron., Baltimore, 27–29 Oct. 1965
(NASA-TM-X-56748) CFSTI: HC $1.00/MF $0.50 CSCL 09C

A regulator for linear plants is proposed whose mode of operation allows plant perturbations to go unchecked as long as they are within some bounding hypersurface in perturbed state space. This bounding hypersurface represents some limit on acceptable plant perturbations. When a perturbed state attains the hypersurface a linear feedback control is initiated, optimally driving the state back toward the origin for a fixed amount of time with a fixed amount of control energy. At control shutdown there exists some residual perturbation and the mode of operation continues. Author

N68-29478*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A WORST DISTURBANCE DESIGN CRITERION IN THE THEORY OF ANALYTICAL CONTROL SYSTEMS SYNTHESIS
Thomas E. Carter 7 Jun. 1966 33 p
(NASA-TM-X-53473) CFSTI: HC $2.00/MF $0.50 CSCL 09C

Design techniques of linear optimal control are found to apply to a minimax problem. With a bounded energy constraint on the class of admissible disturbances, the minimax value of an integral quadratic form of state variables and control can be obtained by finding a positive definite steady-state solution of a matrix Riccati equation. The optimal strategies for control and disturbance are linear functions of state which depend on the numerical bound of the class of disturbances, the set of initial conditions, and relative weighting of the state variables in the cost functional. Sufficient conditions for existence of solutions to the minimax problem are thus obtained from the properties of the equivalent optimal multivariable control problem. The results are illustrated by solving a second order example. Author

N68-29502# Royal Aircraft Establishment, Farnborough (England).
REDUNDANCY IN DIGITAL SYSTEMS
F. A. Inskip Sep. 1965 41 p refs
(RAE-TR-65201) CFSTI: HC $2.00/MF $0.50

A number of methods of using redundancy in digital systems is described. Numerical values of reliability are given for a small system of the order of size typical of a satellite data handling system. Two values of reliability are given: one using the best values of component reliability available at the present time and the other using an order lower. Author

N68-29581# Sandia Corp., Livermore, Calif.
THE AUTOMATIC, ADAPTIVE, SERVO CONTROL FOR STOCHASTIC PROCESSES
D. F. Hillyer, Jr. Feb. 1966 42 p refs
(Contract AT(29-1)-789)
(SCL-DC-65-112) CFSTI: HC $2.00/MF $0.50

A short, development history of the design of equalization systems is supplied to acquaint the reader with simulation equipment; with automatic, feedback-control concepts; and with the need for greater control accuracy. The relative advantages and disadvantages of three existing types of systems are discussed. A description of an experimental, 3-channel system designed by Technical Products Company, Los Angeles, California, to Sandia Corporation, Livermore Laboratory specifications is followed by a specific example of its use in an equalization process. A detailed account of the theory, method, and results of tests of the randomness and stationarity characteristics of the existing and experimental automatic-equalization systems is presented. Author (NSA)

N68-29660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE DYNAMICS OF AN AUTOMATIC COURSE SYSTEM
L. A. Komraz 29 Apr. 1966 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 5, 1964 p 54–60
(FTD-TT-65-1784/1+2+4; AD-632308) CFSTI: HC $1.00/MF $0.50

The dynamics of an automatic course with consideration of limiting the turn of the rudder is discussed. The dynamic system of the third order with two nonlinearities are investigated by the method of point transformations. Author (TAB)

N68-29759*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
THE DISCRETE MINIMUM PRINCIPLE WITH APPLICATION TO THE LINEAR REGULATOR PROBLEM
David L. Kleinman and Michael Athans Feb. 1966 28 p refs
(Grant NsG-496; MIT Proj. DSR-9952)
(NASA-CR-76035; ESL-R-260) CFSTI: HC $2.00/MF $0.50 CSCL 09C

The purpose of this report is to summarize in the form of a discrete minimum principle the necessary conditions for optimality which have been derived for the optimal control of a class of discrete-time systems. The discrete minimum principle is used to derive the optimal feedback control law when the discrete dynamical system is linear and the index of performance is quadratic. Author

N68-29839# California Univ., Los Angeles. Dept. of Engineering.
NONLINEAR PROGRAMMING APPLICATION FOR INTEGRATED CIRCUIT DESIGN
Teruyoshi Asai Mar. 1966 145 p refs
(Contracts Nonr-233(52); AT(11-1)-GEN-10)
(Rept.-66-20; AD-632230) CFSTI: HC $4.00/MF $1.00

The nonlinear programming technique which was designed by the author, is based on the created response surface technique (CRST) although the response surfaces are created outside of the solution region. The problem is treated in two different ways, utilizing linear and nonlinear constraints but with the same nonlinear criterion function which represents propagation delay. The constraint equations and the criterion function are derived from the characteristics of monolithic components applied to the basic design considerations of a two-stage DTL NAND-logic circuit fabricated from a single silicon chip. Programs have been prepared which apply the modified CRST method to the problem. Exploitation of these programs demonstrate the feasibility of the optimization scheme in circuit design. The nonlinear constraint program yielded a 4% improvement in propagation delay over the linear case. Considering the difficulties inherent in conventional trial-and-error circuit design methods, the relative ease of applying the optimization scheme advocated here, and the

results obtained by this method, it is concluded that the technique has definite value in integrated circuit design problems.
Author (TAB)

N66-29643# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR AUTOMATIC CONTROL OF THE MAGNITUDE OF THE THRESHOLD CONTRAST
K. K. Polevitskiy 29 Apr. 1966 5 p Transl. into ENGLISH of Soviet Patent No. 160735 (Appl. No. 804912/26-24, 26 Feb. 1964) 1 p
(FTD-HT-66-80/1+2+4; TT-66-61201; AD-632290) CFSTI: HC $1.00/MF $0.50

The object of the invention is a device of automatic control of the magnitude of the threshold contrast for photoelectric tracking systems with an amplifier which is distinguished by the fact, that with the purpose of detecting single objects on non-uniform background under conditions of highly variable illumination and insuring automatic control of amplification through partial modulation of the input signal from the background, to the input of the amplifier are connected two photoelement load resistors, the smaller of which is shunted by the contacts of a vibrator.
Author (TAB)

N66-29916# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
COMPUTATIONAL ASPECTS OF THE DESIGN OF OPTIMAL DISTRIBUTED COMPONENTS
H. G. Moyer, M. R. Wohlers, and R. E. Kopp Apr. 1966 17 p refs Presented at the 1966 Electron. Components Conf., Washington, 24-6 May 1966
(Contract AF 49(628)-1512)
(RM-3195; AD-481844)

The application of variational techniques for numerically synthesizing optimum distributed networks is discussed. The method circumvents the normal approximation realization cycle of classical network theory and allows realistic constraints to be placed on network parameters. The designs of a lossless distributed bandpass filter and a lossy distributed dummy load or absorber are used to illustrate the techniques.
Author (TAB)

N66-29961# Army Electronics Labs., Fort Monmouth, N. J.
FREQUENCY MULTIPLICATION IN CIRCUITS WITH ABRUPT-JUNCTION VARACTOR DIODES
Werner M. Rupp Feb. 1966 77 p refs Transl. from the German
(ECOM-2666; AD-632537) CFSTI: HC $3.00/MF $0.75

Circuits are analyzed, which utilize abrupt-junction varactor diodes, to generate harmonics of the frequency of the applied pump voltage. As original ideas, the varactor diode is represented by an equivalent circuit, in which the generation of the harmonics is ascribed to a nonlinear voltage source; and the Fourier coefficients of the solutions are represented as power series of the pump amplitude. For any order of harmonic generation, the nonlinear dependence of the Fourier coefficients on the pump amplitude is expressed by auxiliary functions. These functions form an infinite system of equations which has as parameters only the normalized pump voltage and the network functions of the linear circuit, which originates if the varactor diode is replaced by the series connection of a linear condenser and a resistance. Due to the pumping process, the dc charge of the varactor diode is reduced and the average capacitance of the diode increases. It is assumed that the associated detuning of the circuit is corrected by suitably increasing the bias voltage of the diode. All interesting quantites, such as input impedance, output power and efficiency can be expressed as a function of the pump amplitude with only one auxiliary function, which is characteristic for the given circuit. Frequency doubling and frequency tripling with idler are analyzed in detail. For frequency doubling, the results of maximum drive-level operation are presented and optimum design rules are established for four different requirements.
Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-28654# California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
EVALUATION OF ICAO VISUAL AID PANEL APPROACH LIGHTING PATTERNS Final Report
D. M. Finch, R. Hornojeff, and H. G. Paula Feb. 1966 35 p ref
(Contract FAA-ARDS-434)
(SRDS-RD-65-104)

Nine different patterns for the last 1000 feet of approach lights before runway threshold, including two European and seven U.S. configurations, were evaluated on a reduced scale in the Fog Chamber by tests in daytime and nighttime fog (1200-foot visual range). The tests, consisting of observations by pilots, showed none of the patterns to be clearly outstanding. Two of the patterns judged fairly effective (one from the United Kingdom and one from the U.S.) also exhibited a serious shortcoming. Among the most acceptable of the patterns tested were two modified versions of the current U.S. standard and the one proposed by The Netherlands.
Author

N66-28797*# Illinois Univ., Urbana. Coordinated Science Lab.
BAKEOUT PROCEDURES FOR SMALL GLASS ULTRA-HIGH VACUUM SYSTEMS. REDUCTION OF O_2 TO CO CONVERSION
In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 126-135 refs
(See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

The performance of 1-3 liter Pyrex glass ultrahigh vacuum systems was examined. A magnetic deflection type mass spectrometer was included for partial pressure measurements, and Bayard-Alpert gauges and Schuemann photocurrent suppressor gauges were used for total pressure measurements. The bakeout procedures for obtaining pressures below 10^{-11} Torr two to three days after exposing the system to atmospheric pressure are outlined. The main residual gas during bakeout and outgassing was CO; H_2 became the major residual gas when the system was close

to room temperature. The dominant partial pressures observed under different conditions are presented for helium, hydrogen, and carbon monoxide. The influence of processing upon CO production under O_2 admission was also investigated. It was found that keeping the valve and the glass tubing between valve and trap at room temperature during bakeout results in oil condensation taking place. On the other hand if these are kept at about 150°C, no oil condensation was noticed, and the CO pressure was only around 2% of the O_2 pressure under identical conditions. N.E.N.

N66-28899*# Virginia Polytechnic Inst., Blacksburg.
PROCEEDINGS OF THE CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, PART A
[1964] 137 p refs Conf. held 17–21 Aug. 1964 Sponsored by NASA and NSF *Its* Eng. Extension Ser. Circ. No. 4, Pt. A (NASA-CR-64952) CFSTI: HC $4.00/MF $1.00 CSCL 14B

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1. VACUUM TECHNOLOGY D. Santeler (Aero Vac Corp.) 24 p (See N66-28900 16-12)
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3. IONIZING PARTICLES RADIATIONS EFFECTS AND SIMULATION CONSIDERATION J. E. Duberg and W. C. Hulton (NASA, Langley Res. Center) 50 p refs (See N66-28902 16-24)
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5. MAGNETIC FIELDS: REASONS FOR SIMULATION AND METHODS AVAILABLE N. F. Hess (NASA, Goddard Space Flight Center) 35 p refs (See N66-28904 16-29)

N66-29068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A THEORETICAL INVESTIGATION OF SIMULATION IN EXPANSION TUBES AND TUNNELS
Robert L. Trimpi Washington, NASA, Jun. 1966 61 p refs (NASA-TR-R-243) CFSTI: HC $3.00/MF $0.75 CSCL 14B

A preliminary theoretical analysis was conducted of expansion-tube and expansion-tunnel simulation whereby the postnormal shock stagnation conditions of a model were matched to those of flight for both a perfect gas and equilibrium real air. The selected simulation mode permitted large variations from flight conditions for the test-section ambient temperature and pressure. A brief treatment of the perfect-gas expansion tunnel with simulation demonstrated both gains and penalties in driver performance, depending on the Mach number, nozzle area ratio, driver gas, and simulation temperature ratio. A more exhaustive analysis of an equilibrium real-air expansion tube employing simulation with ambient-gas temperatures of 1000° and 2000° K was completed for equivalent flight velocities from 20,000 to 50,000 feet per second and altitudes from 100,000 to 300,000 feet. The primary advantages of simulation were found to be large increases in testing time, initial test-gas slug length, and velocity-altitude performance. For equilibrium flow the gas state behind a shock wave was found to be closely simulated by all strong shock waves and to be well simulated even by weak waves with flow deflections as low as 30°. Author

N66-29149# Pillsbury Mills, Inc., Minneapolis, Minn.
FORMULATION AND FABRICATION OF FOOD BARS Final Report, 30 Mar. 1962–20 Mar. 1963
Jack R. Durst Natick, Mass., Army Natick Labs., Feb. 1966. 55 p
(Contract DA-19-129-QM-1970(016063))
(TR-66-29-FD; FD-39; AD-631996) CFSTI: HC $3.00/MF $0.50

Formulation, production and storage studies of food bars made from various cereal products (wheat flakes, oats, rice crispies and graham crackers), as well as beef, hash and soup type bars (split pea, potato flakes), are presented. The basic matrix for the food bars is a stable binder formulated from protein (sodium caseinate), fat (lard flakes), and carbohydrate (sucrose). The binder is spray-dried, admixed with the food component, and compressed into bar form. Author (TAB)

N66-29159# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
INSTRUMENTATION AND CALIBRATION OF UTIAS 11 IN.×15 IN. HYPERSONIC SHOCK TUNNEL
Y. Y. Chan, R. P. Mason, and N. M. Reddy Jun. 1965 101 p refs
(Grant AF-AFOSR-365-65)
(UTIAS-TN-91; AF-AFOSR-66-0002; AD-631933) CFSTI: HC $4.00/MF $0.75

An outline of the problems encountered in the calibration of the UTIAS 11 in.×15 in. hypersonic shock tunnel and some of the solutions are presented. An impulsively heated tungsten-wire technique was successfully developed to obtain detonation-free, smooth, and very repeatable combustion by burning stoichiometric mixtures of oxygen and hydrogen, diluted with helium. It was found that tailored shock Mach numbers as high as M_s=9.5 were achieved. A test section flow calibration was done by measuring wall static pressures, pitot pressures and stagnation point heat-transfer rates. Qualitative pressure-time histories of static and pitot pressures obtained from theoretical considerations were used to interpret the experimental data as well as the nozzle starting time and testing times. Schlieren pictures of the flows over a flat plate and a right circular cylinder are also presented. Methods of predicting the test-section flow quantities in the different flow regimes are indicated. Nozzle starting processes are explained by utilizing available theories. The reservoir and test section conditions were usually P_0=30 atmospheres to 90 atmospheres; T_0=3000°K to 4500°K; θ=1.00–1.35; P_∞=0.003 to 0.02 psi, P_{t_2}=0.1 to 0.8 psi, M_∞=8.0 to 13.8, Re/ft=1.5×10⁴ to 3.82×10. TAB

N66-29315# Atomic Weapons Research Establishment, Aldermaston (England).
A FACE-ON VERTICAL BLAST LOADING SIMULATOR FOR STRUCTURAL RESPONSE STUDIES
R. Clare Feb. 1966 39 p refs
(AWRE-E1/66) HMSO: 7s

This report describes a vertical blast simulator which produces a reflected blast overpressure of 13–400 psi with a duration of 20–24 ms. Examples of the pressure-time records obtained are given and are compared with that of a "classic" blast wave. Author

N66-29330*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SA-8/APOLLO FIRING TEST REPORT

E. R. Mathews 10 Mar. 1965 40 p
(NASA-TM-X-56408; K-PA-0002) CFSTI: HC $2.00/MF $0.50 CSCL 22D

Apollo/Saturn Space Vehicle SA-9, fourth of six Saturn I, Block II vehicles, was launched at 0937 EST on February 16, 1965, from Pad 37B at Cape Kennedy. All test objectives were successfully accomplished. The S-IV stage, IU, and the Apollo spacecraft were injected into a near-earth orbit. The Pegasus A payload, installed in the Service Module, deployed its wings and functioned as a micrometeoroid measurement system as planned. Propellant transfer systems, ground support equipment, electrical support equipment, and the ground computer operated satisfactorily as did launch vehicle instrumentation and electrical systems. A torus ring water supply pipe separated at several joints after vehicle liftoff. Known water damage to equipment is not considered to be serious at this time. SA-9 caused less damage to LC-37 facilities and equipment than any previous launch. Author

N66-29340*# North American Aviation, Inc., Downey, Calif. Aerospace Sciences Div.
ENGINEERING METHOD TO PREDICT SATURN V VEHICLE AND LAUNCH COMPLEX ENVIRONMENTS DUE TO ROCKET JET IMPINGEMENT Quarterly Progress Report No. 2, 1 Oct.–31 Dec. 1964
A. Africano 15 Jan. 1965 56 p refs
(Contract NAS8-11407)
(NASA-CR-57601; SID-65-44) CFSTI: HC $3.00/MF $0.50 CSCL 22D

The correlation between theoretical prediction methods and available experimental data is examined to predict force and heat load environments due to rocket jet impingement on space vehicles or nearby structures represented by flat and curved surfaces. Three J-2 engine cases were calculated to determine the effect of varying specific heat ratio on the plume; results indicate that an appreciable decrease in the width of the plume boundary occurs compared with that obtained using an assumed constant specific heat ratio. The Newtonian impact pressures of the freestream for computing the jet plume for a moving nozzle were incorporated into the Apollo jet plume computer program. The empirical sea level plume decay ratios for pressure, temperature difference, and velocity were tabulated; remarkably good correlation was obtained between the predicted impact pressures and test data for the SA5 launch. The contribution by plume radiation of a larger portion of the total heat load measured than accounted for in the equations was investigated, and the radiation from solid particles is considered. Preliminary results indicate that the level of radiation flux will be far smaller than that obtained by convection heat transfer. L.E.W.

N66-29364*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A 3-INCH COMBUSTION DRIVE SHOCK TUBE FOR STUDYING CHEMICAL KINETICS
Perry P. Polentz and Leroy L. Presley [1965] 43 p refs Presented at the 23rd Semiann. Meeting of the Supersonic Tunnel Assoc., New York, 3–4 May 1965
(NASA-TM-X-56497) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The principal features of a combustion driven shock tube designed primarily for studying chemical kinetics are described. Velocities as high as 20,000 fps, equilibrium temperatures of 7500°K, pressures between 1/2 and 5 atm, and testing times of 100 to 150 microseconds are available in gas samples behind the incident shock wave. Also included are descriptions of its associated equipment, pertinent operating procedures, operating ranges available, and some results obtained thus far. R.N.A.

N66-29365*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
IMPROVEMENTS IN COMBUSTION SMOOTHNESS AND EFFICIENCY IN A LARGE SHOCK-TUBE DRIVER
Dale L. Compton [1965] 9 p refs Presented at 23rd Semiann. Meeting of the Supersonic Tunnel Assoc., New York, 3–4 May 1965
(NASA-TM-X-56498) CFSTI: HC $1.00/MF $0.50 CSCL 14B

This paper describes a probable cause of pressure oscillation moving from end to end in the driver tube of a large hypervelocity free flight wind tunnel facility, and the steps which have been taken to minimize the disturbance. Preliminary tests were conducted in a 32-ft long 13-in diameter combustion chamber. Results show that obstructions in two-dimensional radial burning are likely to produce strong pressure disturbances which will increase heat loss rates from the driver gas, and perhaps lead to erratic shock tube performance. With no large obstructions to radial burning, nearly disturbance free combustion was demonstrated and pressures reached 93% of theoretical. R.N.A.

N66-29392*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A UNIQUE SUSPENSION SYSTEM FOR LONGITUDINAL VIBRATION TESTING OF LARGE LAUNCH VEHICLES
James A. Schoenster, Jerome Pearson, and Grayson V. Dixon [1965] 24 p refs Presented at the 35th Shock and Vibration Symp., New Orleans, 25–28 Oct. 1965
(NASA-TM-X-56859) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A description is presented of a unique automatically controlled air spring suspension system used in longitudinal vibration tests of large vehicles. Test results indicate that the system fulfills all operational requirements. Author

N66-29413*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
TECHNIQUES OF IMPLEMENTING LAUNCH AUTOMATION PROGRAMS (SATURN IB SPACE VEHICLE SYSTEM)
William G. Bodie 30 Jul. 1965 22 p refs Presented at the 4th Ann. Reliability and Maintainability Conf., Los Angeles, 30 Jul. 1965
(NASA-TM-X-53274) CFSTI: HC $1.00/MF $0.50 CSCL 14B

This paper identifies the methods and equipment through which automation is becoming a major factor in testing and launching Saturn IB space vehicles. The merits of a digital guidance computer and its impact in extending automated checkout are stressed; also a logical basis is established for computer and manual test control. Hardware and software elements of the automated system are described, and details pertaining to reliability are emphasized. A concluding appraisal suggests that automation will play an expanding role in future test and launch operations. Author

N66-29414*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
SOME PERFORMANCE CHARACTERISTICS OF THE LRC 3 3/4-INCH PILOT EXPANSION TUBE USING AN UNHEATED HYDROGEN DRIVER

J. J. Jones [1965] 20 p refs Presented at the 4th Hypervelocity Tech. Symp., Tullahoma, Tenn., 15–16 Nov. 1965 (NASA-TM-X-56706) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Performance characteristics of an expansion tube using a room temperature hydrogen driver are reported. A microwave reflection method was used to supplement the usual pressure transducers, ion gaps, and collimated photomultipliers to measure velocity in the expansion tube. The microwave signal detects the shock wave passage in the intermediate chamber and the helium–air interface in the acceleration chamber. Flow acceleration upon rupture of the secondary diaphragm occurs in approximately 2.5 to 4.0 ft of travel. The subsequent deceleration of the interface averages about 5% over the next 35 ft of travel. Pitot pressures were measured for a wide range of initial acceleration chamber pressure corresponding to varying amounts of expansion of the shocked gas. Pitot pressures were consistently less than predicted by theory. Pitot pressure correlation with wall static pressure and possible causes of the discrepancies are examined and discussed. The secondary diaphragm rupture generates additional waves not considered in the elementary analysis. Consideration of methods to avoid this momentum loss led to the use of electromagnetic forces to open the diaphragm. Results show that a small amount of electrical energy will open a 1/64-in diaphragm to a 6-in diameter in 200 microseconds or less. R.N.A.

N66-29483# Royal Aircraft Establishment, Farnborough (England).
AN AIR LAUNCHING SYSTEM FOR BANNER TARGETS
F. C. Bluett, D. R. Bettison, and G. W. H. Stevens London, Min. of Aviation, Mar. 1964 48 p refs
(RAE-TN-MECH-ENG-397) CFSTI: HC $2.00/MF $0.50

Banner targets for air to air gunnery practice are normally towed off the ground to operational height at the limiting speed for the target, usually below 250 kts. This towing to altitude seriously reduces the already limited endurance of jet tug aircraft. If a target is shot away or lost early in the sortie there is no reserve available and this means abortive sorties for fighters awaiting their turn to attack. To overcome these difficulties a system has been developed to launch targets in flight at the operational height. The target and its tow rope are stowed in a detachable pod mounted on a wing pylon. With one pod under each wing, this provides a primary target with one reserve. These targets can be deployed by the pilot at heights up to 30,000 ft at speeds of 150 kts I.A.S. Snatch on the rope at deployment of the target becomes more severe both with increased speed and increased height. Twin engined aircraft can launch and tow the target directly from the pod itself, but in the case of single engined machines it is necessary to transfer the tow point to the center-line of the fuselage in order to avoid the asymmetric drag load. Author

N66-29516*# General Dynamics/Convair, San Diego, Calif.
OPERATIONAL CONFIGURATION DATA FOR CENTAUR GSE AND FACILITIES. VOLUME I: AIRFRAME AND MECHANICAL SYSTEMS
B. R. Foushee 30 Dec. 1965 315 p
(Contract NAS3-3232)
(NASA-CR-75872; GD/C-BNZ-65-034, Vol. I) CFSTI: HC $7.00/MF $1.75 CSCL 22D

Data are presented on systems and associated interfaces which have a structural or mechanical primary function in the Centaur launch vehicle. Included are data on: vehicle weight and center of gravity, vehicle airframe systems, payload interfaces, booster interfaces, airframe separation systems, environmental control systems, propulsion systems, propellant loading systems, pneumatic systems, and hydraulic systems. H.S.W.

N66-29517*# General Dynamics/Convair, San Diego, Calif.
OPERATIONAL CONFIGURATION DATA FOR CENTAUR GSE AND FACILITIES. VOLUME II: ELECTRICAL AND ELECTRONIC SYSTEMS
B. R. Foushee 30 Dec. 1965 239 p
(Contract NAS3-3232)
(NASA-CR-75873; GDC-BNZ-65-034, Vol. II) CFSTI: HC $6.00/MF $1.25 CSCL 22D

The electronic and electrical systems, associated with both ground and flight operations, of the Centaur launch vehicle are described. The electrical power and control systems, the flight control system, the guidance system, RF systems, and the telemetry system are considered. Charts and block diagrams which identify system components and their functions are included. H.S.W.

N66-29518*# General Dynamics/Convair, San Diego, Calif.
OPERATIONAL CONFIGURATION DATA FOR CENTAUR GSE AND FACILITIES. VOLUME III: SERVICE AND SUPPORT SYSTEMS
B. R. Foushee 30 Dec. 1965 249 p refs
(Contract NAS3-3232)
(NASA-CR-75868; GD/C-BNZ-65-034, Vol. III) CFSTI: HC $6.00/MF $1.50 CSCL 22D

The service and support systems for the Centaur launch vehicle are described, including the electrical and mechanical umbilicals, the umbilical water system, and umbilical circuit and plug checkout. A discussion is also provided of the vehicle transport and handling fixtures required to move the Centaur vehicle from the factory to the launch site, erect the vehicle at the launch pad, and operate the service tower stretch system. The functions of the service tower are examined, and data is presented which defines the event-time relationships and equipment limitations that must be maintained to satisfy the requirements of the Centaur systems. H.S.W.

N66-29644*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MISSION CONTROL CENTER AND NETWORK
Henry E. Clements, Richard L. Holt, and Douglas W. Carmichael *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 169–177 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

As planning for the Gemini Program began, the capabilities of both the Mercury Control Center at Cape Kennedy, Fla., and the Manned Space Flight Network were reviewed and found inadequate to support the Gemini rendezvous missions. A new control center with expanded facilities was required to support the Gemini missions and the advanced flight programs of the future. Major modifications to the Manned Space Flight Network were also required. Equipment used in both systems was generally off the shelf, with proven reliability. Mission results have proved both support systems to be satisfactory. Author

N66-29648*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACECRAFT LAUNCH-SITE PROCESSING

J. R. Atkins, J. F. Thompson, and R. J. Teti *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 221–232 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

In this report, the data of interest with regard to the processing of the Gemini spacecraft are analyzed. The time required for processing any particular spacecraft is dependent not only upon the tests required but also upon the number of manufacturing tasks, the number of tasks that can be worked concurrently, and the amount of time available. The influence of discrepancies found during testing and the number of discrepancies per testing hour can be predicted. In addition, such other parameters as the number of processing tasks and the number of testing shifts have been suitably combined with other factors into a mathematical model for predicting the number of days required at launch complex 19 at Cape Kennedy, Fla. Author

N66-29693# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

DESCRIPTION OF THE 120-INCH HYPERSONIC SHOCK TUNNEL AND ANTICIPATED PERFORMANCE

Philippe O. Bouchard and Harold F. Chambers, Jr. Jan. 1966 30 p refs

(AFAPL-TR-65-129; AD-632234) CFSTI: HC $2.60/MF $0.50

A 120-inch hypersonic shock tunnel has been installed in the Air Force Aero Propulsion Laboratory to provide a capability for testing advanced ramjet engine components and large-scale propulsion systems. The shock tunnel utilizes driver gases that are unheated; presently, either hydrogen or helium, pressurized to 30,000 psia, is used as the driver gas. The tailored interface technique is used to allow for maximum testing time. The facility in its present configuration yields test Mach numbers in the range 18 to 35. Modifications are being made to extend this range to approximately Mach 8 to 10. Author (TAB)

N66-29706*# Baird-Atomic, Inc., Cambridge, Mass.

PELLICLE BEAM SPLITTER Final Report, 15 Feb.–31 Dec. 1965

William Vaughan [1966] 87 p refs *Its* Rept.-5331-FR

(Contract NAS5-9555)

(NASA-CR-75988) CFSTI: HC $3.00/MF $0.75 CSCL 14B

This report describes the work done for the development and fabrication of a pellicle beam splitter. The work consisted of a literature survey to determine state of the art on pellicle materials and coating design, a computer analysis of the suggested metal and dielectric coatings, and the selection of the most promising candidate materials for trial. Methods were then developed for producing thin pellicles of the candidate materials and for applying coatings to them. A strain-free mount was designed and fabricated, and the final pellicle beam splitter was fabricated. Cellulose nitrate and Parylene N can both be formed to a thickness of as little as 0.1 micron, show a minimum of absorption in the infrared region, and are mechanically strong enough to withstand fairly severe environmental conditions. Propylene has excellent absorption and mechanical properties and can be formed to the thickness desired, but it presents problems of nonuniformity in thickness and flatness. The satisfactory coating developed was a trilayer coating of zinc sulfide and germanium. Special techniques were designed to permit deposition of this coating on cellulose nitrate and Parylene N. Author

N66-29711*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

EXPERIMENTAL STUDY OF STERILE ASSEMBLY TECHNIQUES. VOLUME II: APPENDIXES B AND C Final Report

21 Mar. 1965 178 p Prepared for JPL

(Contracts NAS7-100; JPL-950993)

(NASA-CR-75979; M-56-65-1) CFSTI: HC $5.00/MF $1.00 CSCL 14B

A rough, narrative, day-to-day log of work conducted in the sterilization laboratory is given, and the rough log sheets maintained for the operation of the sterilization equipment are presented. Author

N66-29856# Physics International Co., San Leandro, Calif.

EXPLOSIVE GAS GUN FOR RE-ENTRY SIMULATION Final Report

Douglas Mumma 24 Nov. 1965 78 p refs

(Contract DA-04-200-AMC-796(X))

(PIFR-024; AD-630801) CFSTI: HC $3.00/MF $0.75

An inexpensive high explosive gas gun using new concepts has been developed launching intact plastic projectiles, weighing from 4 gms to 100 gms to velocities in excess of 6 mm/μsec. A 2.3-kgm projectile was launched at similar velocity, but broke into discrete pieces. The cause of fragmentation is thought to be the method of seating the projectile. The design has proved to be scalable by a factor of 8, and launches projectiles reproducibly.

Author (TAB)

N66-29909*# Martin Co., Denver, Colo.

DESIGN HANDBOOK FOR PROTECTION OF LAUNCH COMPLEXES FROM SOLID PROPELLANT EXHAUST

E. Lays Mar. 1966 58 p refs

(Contract NAS10-2300)

(NASA-CR-76058; AD-66-11) CFSTI: HC $3.00/MF $0.50 CSCL 22D

This report discusses and presents data relative to the thermal, pressure, and acoustic environment created by the exhaust of solid propellant rocket engines, describes the effect of lift-off acceleration on erosion, and discusses key deflector and exhaust duct parameters to be considered in the design of a launch facility. Factors to be considered in selecting deflector coatings are briefly mentioned and the desired characteristics of a refractory concrete deflector coating are listed. Data sheets containing the characteristics of four candidate deflector coatings and Fondu Fyre WA-1 and XB-1, with a chemical analysis of the latter two, are given together with the methodology for mixing, placement, bonding, finishing, and curing, and a guide specification for pneumatic placement. Also included are discussions on the behavior prediction, maintenance and refurbishment methods, and cost data for deflector coatings; and utilization criteria, desired characteristics, relative performance, behavior prediction, and cost data for thermal protective coatings. R.N.A.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-28543*# TRW Systems Group, Redondo Beach, Calif.
AN ANALYTICAL STUDY OF LIQUID OUTFLOW FROM CYLINDRICAL TANKS DURING WEIGHTLESSNESS Final Report
Leslie R. Koval and Pravin G. Bhuta 1 Jun. 1966 46 p refs (Contract NAS3-7931)
(NASA-CR-54974; TRW-4531-600S-RO-000) CFSTI: HC $2.00/MF $0.50 CSCL 20D

In this investigation, a theoretical solution is given for the configuration of the liquid-vapor interface during liquid outflow from a cylindrical, flat-bottomed tank under conditions of weightlessness. The study is an attempt to obtain an engineering solution to a physical problem which is quite complex because of the effects of viscosity and nonlinearities associated with the motion of the interface. The linearized solution presented assumes inviscid, incompressible, and irrotational flow. It is found that the interface can be expected to oscillate during outflow, and that the Weber number is the appropriate scaling parameter (for draining during a state of complete weightlessness). Author

N66-28676# Aeronautical Research Council (Gt. Brit.)
A UNIFIED THEORY OF FRICTION, HEAT TRANSFER AND MASS TRANSFER IN THE TURBULENT BOUNDARY LAYER AND WALL JET
D. B. Spalding (Imp. Coll. of Sci. and Technol.) London, HMSO, 1965 144 p refs Supersedes ARC-25925
(ARC-CP-829; ARC-25925) CFSTI: HC $4.00/MF $1.00

General equations are derived for the conservation of mass, momentum and any other conserved property, and their solution is made possible by means of: (1) introduction of three-parameter profiles, (2) a hypothesis about entrainment from the mainstream into the boundary layer. Applications are made to the following plane uniform-property flows along smooth walls: the impermeable flate plate; the impermeable wall in the presence of an adverse pressure gradient; the flat plate with mass transfer; the wall jet in stagnant surroundings; and heat transfer in the absence of mass transfer. The assumptions appear to be sufficiently realistic and flexible to provide a simple single calculation method for the above processes, even when these operate simultaneously and in conjunction with roughness, three-dimensional, flow reversal, and variable-property effects. Author

N66-28842# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIATION PROBLEM OF THREE-DIMENSIONAL SUPERSONIC FLOWS
V. M. Borisov *In its* Appl. Math. and Mech. 18 Feb. 1966 p 1–18 refs (See N66-28841 16-23) CFSTI: HC $4.60/MF $0.50

The designing of the supersonic part of a nozzle which possesses maximum thrust was investigated. The supersonic flow in the nozzle was assumed to be spatial, and differential equations of the flows are used as the connections between the functions. The necessary conditions of the extremum obtained in the statement of the variation problem represent a boundary problem for a system of nonlinear equations. The variation problem is formulated and the necessary conditions of the extremum are designated. The number of independent variables in the boundary problem is reduced, and an expression is developed describing the plane eddy-free flow of a compressed fluid. N.E.N.

N66-28864# Royal Aircraft Establishment, Farnborough (England).
THE LAMINAR BOUNDARY LAYER ON AN INCLINED CONE
J. C. Cooke Aug. 1965 34 p refs
(RAE-TR-65178) CFSTI: HC $2.00/MF $0.50

A solution to the problem of incompressible conical flow past a cone is presented, in which the boundary layer equations are solved by an implicit finite difference procedure. Comparisons are made with experiments by Rainbird, Crabbe and Jurewicz, and with calculations made by Crabbe who used an approximate method due to Cooke. The present calculations agree reasonably well with experiment and show that the approximate method gives a fair overall picture. Author

N66-28893# Joint Publications Research Service, Washington, D. C.
CERTAIN PROBLEMS IN THE PHYSICS OF CAVITATION
B. R. Lazarenko, Yu. N. Paukov, and M. K. Bologa *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 46–67 refs (See N66-28888 16-15) CFSTI: $4.00

An overview is presented of research on the origin and development of cavitation, and the secondary phenomena caused by it. Attention is given to the hypothesis that the electric discharges in the cavitation zone constitute an essential aspect of the process and the resulting damage. Both steam and gas cavitation are discussed, as well as boundary and collapse cavitation. The influence of scale effect is considered in the theory of similarity, of cavitation flow, the formation and development of recesses and erosion are discussed, and results of ultrasonic cavitation on pure materials are reported. Luminescence and ultraviolet radiation are shown to result from electric discharges in cavitation bubbles. Observed electric phenomena in the cavitation process lead to the conclusion that cathodes will provide effective erosion protection. M.W.R.

N66-28900*# Aero Vac Corp., Troy, N. Y.
VACUUM TECHNOLOGY
Donald Santeler *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1964] 24 p Also publ. in Intern. Sci. and Technol., no. 13, Jan. 1963 (See N66-28899 16-11) CFSTI: HC $4.00/MF $1.00

Production of electronic thin films and space simulation in vacuum technology are discussed, limits of vacuums are considered, and some existing vacuum scales are illustrated. Ramifications of molecular flow are discussed, as are gas flow when the orifice is extended into a long pipe, flow through restrictions, zero pressure, and problems related to pumping. A description is given for a typical vacuum system consisting of diffusion and backing pumps, interconnecting lines, necessary gauging, and exhaust chamber. Simulation of the void in space is discussed, and the question of cost is considered. M.W.R.

N66-28918# Hokkaido Univ., Sapporo (Japan). Faculty of Engineering.
THE STABILITY OF ASYMMETRICAL DOUBLE ROWS OF VORTICES IN A UNIFORM SHEAR FLOW
Masaru Kiya and Mikio Arie *In its* Bull. of the Fac. of Eng., No. 37 Jun. 1965 p 37–49 refs (See N66-28916 16-34)
CFSTI: HC $3.00/MF $0.50

In this paper, the authors present a flow model of the vortex system which would be originated in the wake of a two-dimensional bluff obstacle in a uniform shear flow u=Gy+U, together with a discussion on the stability of the vortex system concerned. The stability area is shown in terms of γ and p, where γ is the circulation ratio Γ_2/Γ_1 and p the spacing ratio times π. This flow model can simply be reduced to the Karman vortex street when the velocity profile is uniform, its condition of stability being h/l=0.281. From the momentum considerations, moreover, the drag of the body giving rise to the system can be evaluated.
Author

N66-29004# Purdue Research Foundation, Lafayette, Ind.
STEADY FLOW CHARACTERISTICS OF A SINGLE-PHASE NATURAL CIRCULATION LOOP Technical Report No. 15
H. F. Creveling and R. J. Schoenhals Jan. 1966 50 p refs
(Contract AT(11-1)-1177)
(COO-1177-15) CFSTI: HC $2.00/MF $0.50

One-dimensional steady state single-phase natural circulation flow in a circular loop was analyzed. The resulting correlations are presented for both laminar and turbulent flows for wide ranges of the dimensionless parameters involved. In applying these correlations to a particular case it is necessary to carry out iterative calculations. Example calculations of this kind are given. Experiments were carried out using water, and the measured data were compared with the analytical predictions. Author (NSA)

N66-29008# Los Alamos Scientific Lab., N. Mex.
LONGITUDINAL LAMINAR FLOW OF AN INCOMPRESSIBLE FLUID IN FINITE TUBE BUNDLES WITH m+1 TUBES
Roy A. Axford (Northwestern Univ.) 28 Mar. 1966 94 p refs
(Contract W-7405-ENG-36)
(LA-3418) CFSTI: HC $3.00/MF $0.75

The axial component of the laminar flow velocity field of an incompressible, Newtonian fluid in longitudinal flow in a finite tube bundle containing m+1 tubes in a cylindrical channel is determined by the method of harmonic functions. FORTRAN listings of the main source program together with its three subprograms are given. Author (NSA)

N66-29186# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DEFORMED SPHEROIDS IN STOKES FLOW
V. O'Brien Jul. 1965 63 p refs
(Contract NOw-62-0604-c)
(TR-716; AD-631805) CFSTI: HC $3.00/MF $0.75

A short, straightforward program has been developed for the numerical calculation of viscous flow solutions for arbitrary closed bodies of revolution. Flow solutions have been computed for a variety of body shapes. Results compared well with analytic theory where it exists, but for many bodies there has been no theoretical investigation.
Author (TAB)

N66-29188# David Taylor Model Basin, Washington, D. C.
CAVITATION STUDY OF A PROPELLER OPERATING IN A NONUNIFORM FLOW CREATED BY A WIRE GRID SCREEN
Gary C. Comstock Mar. 1966 33 p refs
(DTMB-2185; AD-631701) CFSTI: HC $2.00/MF $0.50

Tunnel test results are presented for nonuniform flow cavitation studies of a 4-bladed subcavitating propeller. The nonuniform flows were generated by wire mesh screens located upstream from the propeller. The first objective of the tests was to compare the cavitation of the propeller operating in a given axial wake as produced by a wire mesh with the cavitation in the same wake as reported by van Manen. The second objective was to determine the effect on the propeller cavitation of modifying the axial inflow velocity so as to obtain the same local inflow angles as produced by both the axial and tangential wake of the ship. Differences were observed in the cavitation patterns produced by the wakes with and without tangential component correction, but the expected transverse asymmetry was not consistently observed. The cavitation patterns in the uncorrected wake agreed well with those observed by van Manen except that the intensity varied suggesting that the cavitation index used in the two studies may not be equivalent.
Author (TAB)

N66-29248# Naval Ordnance Lab., White Oak, Md.
THE EFFECT OF FLUID INJECTION ON THE INCOMPRESSIBLE LAMINAR BOUNDARY LAYER OVER A SLENDER PARABOLA OF REVOLUTION
Lorenzo M. Albacete 35 p refs
(NOLTR-65-226; Aeroballistics Res. Rept.-257; AD-632263)
CFSTI: HC $2.00/MF $0.50

The combined effect of transverse curvature and fluid injection on the incompressible laminar boundary layer over a parabola of revolution with zero pressure gradient has been examined. This was done by extending the asymptotic solution of Mark to include the effect of injection. In addition, results for finite values of the transverse curvature were obtained by means of a numerical solution of the differential equation. The results show that transverse curvature retards the injection-induced separation of the boundary layer. This allows for higher injection rates that would otherwise be possible. Author (TAB)

N66-29258# Army Missile Command, Huntsville, Ala. Reentry Physics Branch.
ON THE INTEGRATION OF COUPLED NONLINEAR EQUATIONS IN BOUNDARY LAYER THEORY WITH SPECIFIC REFERENCE TO HEAT TRANSFER NEAR THE STAGNATION POINT IN THREE-DIMENSIONAL FLOW
A. A. Hayday and D. Bowlus 24 Jan. 1966 26 p refs
(RN-TR-66-3; AD-632097) CFSTI: HC $2.00/MF $0.50

The purpose of this report is to indicate the accuracy of the asymptotic method in solving systems of nonlinear differential equations in contrast to the methods that deal with a single equation. Also, a ready comparison with corresponding numerical solutions is made by considering a general three-dimensional flow of a viscous incompressible fluid in the vicinity of a stagnation point on a regular surface.
Author (TAB)

N66-29286*# General Dynamics/Convair, San Diego, Calif.
LIQUID OSCILLATIONS AND DAMPING IN A ZERO GRAVITY ENVIRONMENT
G. B. Wood 26 Apr. 1961 12 p Revised
(NASA-CR-54999; GD/C-662-1-560) CFSTI: HC $1.00/MF $0.50 CSCL 20D

During Centaur zero gravity simulation flights in a KC-135 aircraft, it was noticed that liquid nitrogen often escaped from a cold trap on the liquid hydrogen dewar and

formed rapidly oscillating globules and, occasionally, larger bubbles. These globules and bubbles quickly stabilized to spheres as they floated about the cabin. Using dimensional analysis, approximate scaling laws were derived for the liquid behavior. D.T.

N66-29296*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
A NEW FORMULATION OF THE MULTICOMPONENT TRANSPORT EQUATIONS FOR USE IN LAMINAR BOUNDARY LAYER PROBLEMS
Marvin E. Goldstein May 1966 64 p refs /its Fluid Mech. Lab. Publ. No. 66-3
(Grant NGR-22-009-052)
(NASA-CR-75819) CFSTI: HC $3.00/MF $0.75 CSCL 20D

A new formulation of the multicomponent boundary layer problem which is convenient for numerical calculations is developed. This is accomplished by a modification of the usual Chapman–Enskog procedure which is intermediate between that procedure and Grad's thirteen-moment method. The relations which are developed do not involve transport coefficients but rather expressions for the gradients of the physical variables as linear combinations of the fluxes. The complete set of boundary layer equations turn out to be a set of first-order differential equations and a set of algebraic equations which are linear in the fluxes. These expressions contain the averaged cross sections instead of transport coefficients. Author

N66-29314# Atomic Weapons Research Establishment, Aldermaston (England).
FLOW ROUND A PLATE MOVING THROUGH A SHOCK-WAVE
A. I. Golubinskii Mar. 1966 15 p ref Transl. into ENGLISH from Inzh. Zh. (USSR), v. 1, no. 2, 1961 p 26–30
(AWRE-TRANS-51) CFSTI: HC $1.00/MF $0.50

The plane problem of the transitional flow round a plate, moving with supersonic velocity, which penetrates a moving weak shock wave with unsteady flow behind the shock front, is investigated. The problem is resolved by a linear transformation. Author

N66-29383*# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
CAVITATION BUBBLE OBSERVATION IN A VENTURI
R. D. Ivany and F. G. Hammitt Apr. 1965 40 p refs Submitted for Publication /its Rept.-03424-25-I
(Grants NsG-39-60; NSF G-22529)
(NASA-CR-64682) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Bubbles collapsing in water in a cavitating venturi are photographically observed. The large pressure gradient in the venturi causes the bubbles to collapse by flattening in the direction of flow. A comparison of observed collapse rates with incompressible theory for a spherical bubble indicates that the observed slowing down of collapse at small bubble radii may result from compression of vapor within the bubble. Author

N66-29415*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODULATION AND SAMPLING OF HYDROMAGNETIC RADIATION
C. P. Sonett [1965] 76 p refs Presented at the COSPAR-URSI Symp. on Optimization of Instrumentation for Space Expt. from the Standpoint of Data Process., Buenos Aires, May 1965
(NASA-TM-X-56428) CFSTI: HC $3.00/MF $0.75 CSCL 20D

It is shown that detecting electromagnetic signals in the hydromagnetic domain by means of magnetometers is a low frequency extension of the electromagnetic spectrum; therefore, conventional modulation theory is employable, subject to the special constraint that the carrier frequency is determined by spacecraft motions. In the presence of a hydromagnetic continuum, spacecraft spin modulation folds the spectrum so that fictitious offsets, ambient field errors, and the generation of spurious wave signals can occur, the latter from single sideband ing. Synchronous demodulation by means of time quadrature detectors can be employed to remove such effects. Commutated telemetry which time shares experiments is shown to yield a multirate sampled spectrum. This telemetry can cause uncorrectable spectral folding of many orders because it generates a complex switching spectrum containing a subsidiary multiplet structure about each of the principal switching tones. Author

N66-29420*# Consultants and Designers, Inc., Arlington, Va.
SIMPLEST PRECISE SOLUTIONS OF THE BOLTZMANN EQUATION FOR RAREFIED GAS FLOWS [PROSTEYSHIYE TOCHNYYE RESHENIYA URAVNENIYA BOL'TSMANA DLYA DVIZHENIYA RAZREZHENNOGO GAZA]
A. A. Nikol'skiy Aug. 1963 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 151, no. 2, 1963 p 299–301
(Contract NAS5-2078)
(NASA-TT-F-8622; ST-AGD-10039) CFSTI: HC $1.00/MF $0.50 CSCL 20D

This paper considers flows of a monatomic gas or monatomic gas mixtures in an infinite three-dimensional space for which the distribution functions of particles' natural velocities is identical for all points. Author

N66-29439*# National Aeronautics and Space Administration, Washington, D. C.
DETONATION WAVES IN GASES [DETONATSIONNYYE VOLNY V GAZAKH]
R. I. Soloukhin Feb. 1964 49 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 80, no. 4, Aug. 1963 p 525–551
(NASA-TT-F-8803) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A survey of the latest achievements in the study of detonations in gases is presented. Subjects discussed in particular are: (1) structure of the detonation wave; (2) experimental methods of studying the state of the gas behind the detonation front; (3) characteristics of gas ignition behind the shock front; (4) transition from deflagration to detonation in gases; (5) oscillation of the gas behind the detonation front; and (6) detonation in a steady gas flow. A large (125 references) bibliography of both Soviet and non-Soviet literature is included. P.V.E.

N66-29459*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CONTACT-SURFACE TAILORING IN REAL SHOCK TUBES
Theodore A. Brabbs and Frank E. Belles [1965] 15 p refs Submitted for Publication
(NASA-TM-X-56735) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The equilibrium pressure after interaction of a reflected shock with the contact surface can be confused with the tailored state, unless quantitative pressure measurements are made. Such measurements were used to find the true tailored conditions for CO_2+Ar and CO_2+Ar+He mixtures, and for N_2 driven by He. Calculated conditions in excellent agreement with these resulted when the real performance of the tube, instead of the ideal performance, was employed in the usual tailoring formula. This suggests a rapid systematic way to produce the tailored state, and shows that it will not be the same in all tubes. However, a small pressure excursion due to contact-surface interaction still remains even when perfect tailoring is achieved. Author

N66-29480*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF TAILORED-INTERFACE OPERATION OF SHOCK TUBES WITH HELIUM-DRIVEN PLANETARY GASES

William J. Loubsky and John O. Reller, Jr. Washington, NASA, Jul. 1966 51 p refs

(NASA-TN-D-3495) CFSTI: HC $2.00/MF $0.50 CSCL 22D

The perfect-gas relations which determine the conditions for tailored operation of a shock tube are summarized, and a computer method for calculation real-gas effects is presented. Equations are derived that enable the determination of the time, τ, during which the reservoir properties remain constant. It is shown that a maximum value for τ exists for a range of driven-to-driver tube length ratios; an optimum ratio is defined for minimum driver length at maximum τ. A minimum value for τ also exists if tailoring is to be achieved and corresponds to an allowable maximum component length ratio. Charts are presented which facilitate the determination of the tailored conditions for a constant area shock tube having a helium drive and air, CO_2, N_2, or A as test gases. Driver conditions are varied to include pressures from 10 to 1500 atm and temperatures from 300° to 10,000°K. Substantial deviations from the perfect-gas results are found for tailored Mach numbers greater than 8. For a given reservoir or reflected-shock enthalpy, real-gas effects may reduce driver temperature requirements by 30 to 50 percent. Driver energy is reduced also, since real-gas effects enable the use of a shorter driver length. Steady-state times τ, however, can be substantially less than the perfect-gas values. Author

N66-29492# Gt. Brit. Ministry of Aviation, Mottingham. Technical Information and Library Services.

INTERACTION OF PERTURBANCES WITH A SHOCK-WAVE IN THE CASE OF ONE-DIMENSIONAL NON-STEADY MOTION OF A GAS [O VZAIMODESTVII VOZMUSHCHENII S UDARNOI PRI ODOMERNOM NEUSTANOVIVSHEMSYA DVIZHENII GAZA]

Zh. S. Sislyan Nov. 1965 10 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), v. 3, 1963 p 153–155

(TIL/T-5607) CFSTI: HC $1.00/MF $0.50

The motion of gas under the action of a piston with variable velocity moving in a long cylindrical tube is analyzed mathematically. At the time under consideration the piston velocity differs only slightly from some constant value. The field of flow between piston and shock-wave is examined. Author

N66-29507*# General Dynamics/Convair, San Diego, Calif.

ZERO-G REPORT, BUBBLE ACCUMULATION IN SIMULATED BOILING

Leon Mc Crary 1 Jun. 1962 18 p refs

(NASA-CR-75924; GD/C-55D-859-6) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The primary aim of the investigation described herein was to determine if fuel would escape through a Centaur center vent during a venting period in zero gravity. A secondary aim was to develop a scaling law for bubble population development in zero gravity. The problem was approached from an empirical point of view, since no really convincing general theory had been suggested. Boiling was simulated in drop tests and in liquid/liquid tests, using scale models of the Centaur LH_2 tank. Author

N66-29528# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Institut für Theoretische Gasdynamik.

TWO-DIMENSIONAL SUPERSONIC FLOW WITH RELAXATION [EBENE STROEMUNG MIT RELAXATION]

Fritz Bartlmae Jul. 1965 35 p refs In GERMAN; ENGLISH summary

(DZR-FB-65-34; DVL-442)

Supersonic wind-tunnel expansions occur so rapidly that thermodynamic equilibrium cannot set up. During expansion the water vapor in the air is supercooled, and the supersaturated state suddenly collapses on a short distance in flow direction. The disturbance marking the collapse is customarily called a condensation shock. A two-dimensional treatment of this process by the method of characteristics is presented as an example for the motion of a relaxing gas. Author

N66-29549# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

THE EFFECT OF UPSTREAM VELOCITY PROFILE ON THE FREE MIXING OF JETS WITH AMBIENT FLUID

I. Wygnanski and O. Hawaleshka (McGill Univ.) Apr. 1966 33 p refs *Its* Flight Sci. Lab. Rept.-106

(D1-82-0528)

The asymmetric-jet created by the mixing of a wall-jet with quiescent surrounding fluid downstream of a trailing edge is considered. The method of analytic continuation, developed by Goldstein is extended to provide a series solution for the asymmetric jet. The different boundary conditions as well as the extension to turbulent flow reveal some new aspects which are discussed in detail. In particular, the conservation of momentum downstream of the trailing edge enables one to determine the location of a jet with respect to the y-coordinate. In turbulent flow the analysis has been supplemented by experiment, providing a fair agreement between the two. Author

N66-29600# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CAVITATION ON SURFACE IRREGULARITIES OF TRIANGULAR PROFILE

K. K. Shal'nev 1 Feb. 1966 33 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 6, 1962 p 68–80

(FTD-TT-65-1606/1+2+4; AD-630286) CFSTI: HC $3.60/MF $0.50

Calibration experiments and basic tests on cavitation by a surface irregularity were carried out in a hydrodynamic tube with models of triangular profile. Calibration tests were conducted to determine a connection between the magnitude of

the velocity in the measurement cross section and the pressure at this point. Basic experiments involved influence of pressure changes on cavitation. External forms of cavitation behind a surface irregularity are explained, and the kinematic structure of the cavitation zone is studied with high-speed moving pictures. Experiments are described and results are compared with theoretical values. It was concluded that cavitation in the initial stages develops in a zone of free vortices formed beyond the surface irregularity. The greatest danger with regard to onset of cavitation are irregularities in narrow channels or slots where irregularities small in absolute dimension are relatively large. S.P.

N66-29671# American Meteorological Society, Boston, Mass.
RESULTS OF CALCULATION OF THE BOUNDARY LAYER OF BLUNTED CONES IN SUPERSONIC FLOW [REZUL'TATY RASCHETA POGRANICHNOGO SLOIA NA ZATUPLENNYKH KONUSAKH V SVERKHZVUKOVOM POTOKE]
A. L. Ankudinov Bedford, Mass., AFCRL, Mar. 1966 14 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 5, no. 5, 1965 p 960-966
(Contract AF 19(628)-3880)
(T-R-591; AD-631971) CFSTI: HC $1.00/MF $0.50

The paper presents the results of the calculation of the boundary layer of spherically blunted cones in supersonic airflow for a given (constant) wall temperature and for a thermally insulated wall. Author (TAB)

N66-29698# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
DETERMINATION OF THE STATE OF THE ART IN TWO-PHASE GAS-LIQUID FLOW PHENOMENON Final Report, 1 Feb. 1961-31 Dec. 1965
S. W. Gouse, Jr. 15 Apr. 1966 6 p refs
(Contract Nonr-1841(73))
(AD-632594) CFSTI: HC $1.00/MF $0.50

The purpose of the program was to conduct an extensive and detailed study of the literature on two-phase gas-liquid flow phenomena and to compile the results of such a study in a useful form. A three-part bibliography and subject index to the literature were published listing and indexing by subject 5,253 separate references on two-phase gas-liquid flow phenomena, excluding the problem areas of condensation, cavitation, and atomization. Four technical reports, presenting reviews of various problem areas were also completed and distributed. Author (TAB)

N66-29730*# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
HYDRODYNAMICS OF TIRE HYDROPLANING Final Report, 1 Jul. 1965-30 Jun. 1966
C. S. Martin [1966] 80 p refs
(Grant NGR-11-002-033; Proj. B-608)
(NASA-CR-76018) CFSTI: HC $3.00/MF $0.50 CSCL 20D

The hydrodynamics of pneumatic tire hydroplaning are explained from a purely analytical standpoint. Lift and drag forces on an assumed planing surface (tire) are obtained for an ideal fluid undergoing two-dimensional motion. For the condition of incipient hydroplaning the theoretical lift coefficient is found to be 0.8, compared to a value of 0.7 from experiment. The lift and drag coefficients are shown to decrease as the tire lifts further off the runway. The pressure distribution on the pavement from theory compares favorably with the experimental results. Author

N66-29747*# West Virginia Univ., Morgantown. Dept. of Aero-Space Engineering.
AN EXPERIMENTAL STUDY OF VISCOUS-FLOW NOSE-SHAPE EFFECTS OF IMPACT TUBES
Millard L. Howard 3 Jan. 1966 68 p refs
(Grant NsG-533)
(NASA-CR-76025) CFSTI: HC $3.00/MF $0.75 CSCL 20D

An investigation was performed using water and three oils of different viscosities with a series of pitot tubes of different nose shapes to determine the effects of viscosity and nose shape on pitot tube pressure measurements. Data were collected by means of a rotating arm propelling the pitot tubes through stationary fluids in a circular trough. The results were presented in the form of pressure coefficient as a function of Reynolds number. These results were found to compare favorably with experimental and theoretical results of previous investigations. It was determined that data for similar nose shapes but with different ID/OD (Inside Diameter/Outside Diameter) ratios agree better with Reynolds number based on the OD for square-nosed tubes and with Reynolds number based on ID for hemispherical- and flat-oval-nosed tubes. It was also determined that for the same ID/OD hemispherical-nosed tubes indicate higher pressures than do square-nosed tubes. Author

N66-29748*# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
CAVITATION DAMAGE CHARACTERISTICS IN WATER AND MERCURY FROM STUDIES IN A CAVITATING VENTURI Technical Report No. 17
M. J. Robinson and F. G. Hammitt Apr. 1966 126 p refs
Its Rept.-03424-17-T
(Grant NsG-39-60)
(NASA-CR-76027) CFSTI: HC $4.00/MF $1.00 CSCL 22D

A cavitation research investigation is presented on basic cavitation flow regime studies, individual cavitation bubble collapse studies, and damage to materials associated with both. The bulk of the data was taken at 200 ft./sec. for water and 34 ft./sec. for mercury due to ease of facility operation under these conditions. Among the topics considered are: (a) correlations of damage data with specimen material mechanical properties; (b) microexamination of individual pits including sensitive surface traces of individual pits, and metallographic sections of materials through damage areas; (c) microhardness versus specimen exposure time; (d) damage as a function of material grain size for comparable strength ranges of materials; (e) correlation of pitting rate, pit size, spatial distribution of pits, bubble distribution, and pressure above vapor pressure on the specimen surface, all as a function of axial position on the test specimen polished surface; (f) photographic studies of single bubble collapses in a venturi both away from and near a solid boundary. Author

N66-29826# Brown Univ., Providence, R. I.
SOME NON-NEWTONIAN EFFECTS IN FLOW THROUGH TUBES
A. C. Pipkin Repr. from Proc. of 4th Intern. Cc.. s..on Rheology [1964] p 213-222 refs
(Grant DA(ARO(D)-31-124-G484)
(AROD-1271-44; AD-620830)

Rectilinear flow of nonlinear viscoelastic fluids through straight tubes can only occur if the tube is of circular cross section or if the rheological constants satisfy certain relations. The present review gives a qualitative discussion of

these results and considers the matter of the normal stress distribution on the walls of the tube. The related problem of oscillating flow is discussed briefly. Author (TAB)

N66-29936# Little (Arthur D.), Inc., Cambridge, Mass.
A REVIEW OF FLOW NOISE RESEARCH RELATED TO THE SONAR SELF NOISE PROBLEM
Patrick Leehey Mar. 1966 101 p refs Prepared for Bolt, Beranek, and Newman, Inc.
(Contract NObsr-93055)
(Rept.-4110366; AD-632009) CFSTI: HC $4.00/MF $0.75

This report is a review of the literature concerning the excitation of structures by random pressure fluctuations in a turbulent boundary layer and the consequent acoustic radiation. Such radiation is termed flow noise. The purpose of the report is to determine those aspects of analysis and experiment on the subject that are pertinent to the generation of self noise in a sonar. The report is concerned with the physical mechanisms governing flow noise, with the prediction of the magnitude and distribution in frequency of flow noise, and with the discovery of measures that may be taken to reduce its influence upon sonar self noise. The outstanding research problems remaining in the field are pointed out, and recommendations are made for the direction of further research. Author (TAB)

N66-29938# Colorado State Univ., Fort Collins. Fluid Mechanics Program.
VELOCITY DISTRIBUTIONS IN THE SEPARATED FLOW BEHIND A WEDGE SHAPED MODEL HILL
Shih-Cheng Chang Mar. 1966 118 p refs
(Grant DA-AMC-28-043-620)
(AD-632110) CFSTI: HC $11.60/MF $0.75

A portion of the velocity distributions in an incompressible turbulent separated flow behind a two-dimensional model hill is investigated experimentally. A 2 in.×2 in. wedge is used as a model hill. The mixing region investigated lies between the crest of the hill where the flow separated, and the reattachment point where the separated flow reattaches itself to the floor. Gortler's half-jet mixing theory is used to analyze the separated flow which is curved by the action of the pressure gradient across the separated flow. The width of the mixing region was found to spread linearly with the distance as expressed by the half-jet theory. If a suitable similarity parameter is chosen, the theoretical velocity distribution of half-jet agrees satisfactorily with the experiments, except in the region near the floor and directly behind the hill. However, it was found that the similarity parameter is not a constant, but is proportional to the one-half power of the distance downstream from the hill. Corrections were applied to account for the effects of the initial boundary layer thickness and for the curvature. The corrections are based on Sawyer's first order theory and Kirk's approximation, but the results indicate that these effects should be investigated further. Author (TAB)

N66-29947# General Dynamics/Fort Worth, Tex.
DRIFT VELOCITIES OF SLOW ELECTRONS IN METHANE, ETHANE, ETHYLENE, PROPYLENE, ACETYLENE, AND 1-BUTENE *Technical Report, 1 Oct. 1964-30 Sep. 1965*
C. R. Bowman and D. E. Gordon Kirtland AFB, N. Mex., AF Weapons Lab., May 1966 35 p refs
(Contract AF 29(601)-6643)
(AFNL-TR-66-6; AD-632377) CFSTI: HC $2.00/MF $0.50

A double-shutter drift tube was used to measure the drift velocities of electrons in methane, ethane, ethylene, acetylene, propylene, 1-butene, and ethane–acetylene mixtures for low E/P values. The resulting data were analyzed to obtain values of momentum-transfer cross sections as a function of electron energy in the interval 0.01–0.063 ev. Cross sections for the individual gases were obtained by fitting power series in electron velocity to the slope of the drift velocity curves in the thermal equilibrium range, where the electron velocities can be represented by a Maxwellian distribution. Momentum-transfer cross sections for the dipolar gases–propylene and 1-butene are compared with Altschuler's dipole scattering theory. Author (TAB)

N66-29970*# Catholic Univ. of America, Washington, D. C. Dept. of Space Science and Applied Physics.
ON MASS TRANSFER BETWEEN TWO PARALLEL STREAMS
Y. C. Whang Jun. 1966 22 p refs */ts* Rept.-66-007
(Grant NsG-586)
(NASA-CR-76072) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The convective and diffusive mass transfer between two parallel streams of gases is studied in this paper. When the two gases in the freestreams are of different densities, the flow field is disturbed due to mass diffusion. Solutions for mass concentration, flow velocity, and density are obtained in closed forms. Mass transfer between two parallel streams in transition regime is also studied, slip boundary condition is used, its solution shows a smooth transition between the free-molecule solution and the continuum solution. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-28420# Joint Publications Research Service, Washington, D. C.
RECENT STUDIES IN METEOROLOGY AND OCEANOGRAPHY
3 Jun. 1966 40 p refs Transl. into ENGLISH of 4 articles from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), 1966, no. 3
(JPRS-35818; TT-66-32252) CFSTI: $2.00

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N66-28422# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF SEA SURFACE TEMPERATURE FROM ITS THERMAL RADIO EMISSION
A. S. Gurvich and S. T. Yegorov *In its* Recent Studies in Meteorology and Oceanog. 3 Jun. 1966 p 14–18 refs (See N66-28420 16-13) CFSTI: $2.00

Radiometers with working wavelengths of about 9 cm were used to determine the temperature distribution over the Caspian Sea by aircraft. Results of processed fluctuation data obtained from two flights were compared to temperature data obtained by direct measurements from ships situated near the aircraft flight line. The maximum discrepancy between the values of direct water temperature and aircraft measurements did not exceed 1.5–2.5° C when the temperature contrast over water was between 10° to 12° C. G.G.

N66-28423# Joint Publications Research Service, Washington, D. C.
EFFECT OF THE ANGULAR DIVERGENCE OF A BEAM OF LIGHT ON ITS PENETRATION INTO A DISPERSIVE MEDIUM
A. P. Ivanov and I. D. Sherbaf *In its* Recent Studies in Meteorology and Oceanog. 3 Jun. 1966 p 19–25 ref (See N66-28420 16-13) CFSTI: $2.00

Angular divergence of a light beam illuminating turbid water was studied by varying the entering angle of the light flux from a radiation source as well as the optical characteristics of the medium and thus its coefficient of extinction. Analysis of the obtained data showed that the greater the survival probability of a photon was, the slower was the decrease of illumination at increased aperture angle of the source. Replacement of the acutely directed light source by a completely diffused source decreased the illumination only by 2 to 3 times. G.G.

N66-28559# Joint Publications Research Service, Washington, D. C.
STUDIES IN PHYSICS OF THE FREE ATMOSPHERE
N. Z. Pinus and S. M. Shmeter 31 Mar. 1966 51 p Transl. into ENGLISH from the book "Aerologiya, Chast' II, Fizika Svobodnoy Atmosfery" Leningrad, Gidrometeoizdat, 1965 p 199–207; 310–338
(JPRS-35749; TT-66-32184) CFSTI: $2.00

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2. TURBULENCE IN THE UPPER ATMOSPHERE N. Z. Pinus and S. M. Shmeter p 6–10 refs (See N66-28561 16-13)

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N66-28560# Joint Publications Research Service, Washington, D. C.
TURBULENCE CAUSING AIRCRAFT BUFFETING
In its Studies in Phys. of the Free Atmosphere 31 Mar. 1966 p 1–5 (See N66-28559 16-13) CFSTI: $2.00

The turbulent atmospheric perturbations whose size is from several tens of meters to 1–2 km are reviewed. The characteristics of the turbulent layers are discussed, along with the integral frequency of layer thickness with respect to latitude and the integral frequency of the horizontal dimensions with respect to geographic area. The conditions for turbulence development are described. It is pointed out that turbulent conditions should be expected over mountains and especially on their leeward side. The difficulties in predicting the turbulence in a cloudless sky in the upper troposphere and stratosphere, and especially on a cloudless night, are mentioned. N.E.N.

N66-28561# Joint Publications Research Service, Washington, D. C.
TURBULENCE IN THE UPPER ATMOSPHERE
In its Studies in Phys. of the Free Atmosphere 31 Mar. 1966 p 6–10 (See N66-28559 16-13) CFSTI: $2.00

Studies and experiments relating to upper atmospheric turbulence are surveyed. The use of meteor trails to determine wind velocity fluctuations and atmospheric inhomogeneities is discussed. Strong anisotropy in the ionosphere is reported. It is pointed out that there have been few experiments on the turbulence and its fluctuations, and especially on the vertical distribution of turbulent viscosity. An estimated value of the turbulent viscosity coefficient, on the basis of estimated atmospheric circulation intensity and vertical temperature distribution, is presented. N.E.N.

N66-28562# Joint Publications Research Service, Washington, D. C.
CLOUDS IN THE STRATOSPHERE AND MESOSPHERE
In its Studies in Phys. of the Free Atmosphere 31 Mar. 1966 p 11–18 (See N66-28559 16-13) CFSTI: $2.00

The formation of clouds in the tropopause and the part of the stratosphere immediately adjacent to it, and the upper part of the mesosphere is discussed. It is mentioned that cirrus and cirrostratus clouds sometimes penetrate into the upper part of the tropopause, but they break up rapidly due to the low humidity. The infrequency and the coloring of the mother-of-pearl clouds in the 20–30 km altitude range are reported. The shape, coloring, types, and summer seasonal appearance of the noctilucent clouds are described. The meteor and condensation theories of noctilucent cloud formation are mentioned. N.E.N.

N66-28563# Joint Publications Research Service, Washington, D. C.
MACROSTRUCTURE OF CLOUD FIELDS FROM SATELLITE DATA
In its Studies in Phys. of the Free Atmosphere 31 Mar. 1966 p 19–24 (See N66-28559 16-13) CFSTI: $2.00

The meteorological artificial earth satellite data on the macrostructure of clouds is discussed. The cameras, magnetic tape recording, and data transmission are mentioned. It was found that a specific spiral-like cloud cover system is characteristic for cyclones of the temperate latitudes. The diameter of some systems was measured to exceed 1500 km. The presence of a cellular structure in the cloud cover distribution, and the diameter of individual cells are mentioned. The data indicate that the appearance of a large scale cellular cloud cover is related to the existence of a stable layer above 1.5 km. N.E.N.

N66-28584# Joint Publications Research Service, Washington, D. C.
ARTIFICIAL CLOUD MODIFICATION
In its Studies in Phys. of the Free Atmosphere 31 Mar. 1966 p 25–44 (See N66-28559 16-13) CFSTI: $2.00

A state-of-the-art survey on cloud seeding techniques is presented, and the history of the developing technology is briefly summarized. The forced crystallization of supercooled clouds by carbon dioxide and iodide crystals are described. The aircraft and equipment, and the difficulties involved are indicated. Formulas are developed for the volume of air cooled during the time of a granule's fall, the concentration of nuclei, and the seeding rates. The dispersion of fog and hail clouds is mentioned. The criteria which can be used to determine the effectiveness of modification of hail-bearing clouds are outlined. It was felt that the methods of dissipation of clouds and fogs have been solved for clearing airports, that the problems connected with hail clouds are near solution, but that the dissipation of precipitation over large areas requires considerably more study. N.E.N.

N66-28597# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
THEORETICAL ELECTRON DISTRIBUTIONS IN THE NOCTURNAL F-2 REGION AT MID-LATITUDES
J. D. Cummings 30 Jun. 1966 113 p refs
(Grants NSF G-18852; NSF GP-5611)
(SR-275)

This work is concerned with appropriate solutions of the continuity equation for the nocturnal F-layer electron distribution and is essentially an extension of a study of Dungey (1956). Temporal variations are dealt with utilizing ambipolar diffusion and recombination coefficients, whose values are an important consideration in any F-region study, deduced from the model studied. Author

N66-28646# Joint Publications Research Service, Washington, D. C.
RECENT DEVELOPMENTS IN SOVIET OCEANOGRAPHY
17 Feb. 1966 45 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 5, no. 6, Nov.–Dec. 1965 p 1028–1042, 1083–1084, 1095–1099, 1110–1112
(JPRS-34177; TT-66-30618) CFSTI: $2.00

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2. SOUND-SCATTERING LAYERS AS INDICATORS OF INTERNAL WAVES IN THE OCEAN Yu. G. Chindonova and V. A. Shulepov p 17–24 refs (See N66-28648 16-13)

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N66-28647# Joint Publications Research Service, Washington, D. C.
ACOUSTIC CHARACTERISTICS OF SOUND-SCATTERING LAYERS IN THE OCEAN AND DATA OF ECHO SOUNDING AND DIRECT CATCHING OBSERVATIONS
I. B. Andreyeva *In its* Recent Develop. in Soviet Oceanog. 17 Feb. 1966 p 1–16 refs (See N66-28646 16-13) CFSTI: $2.00

Acoustic characteristics of sound scattering oceanic layers and faunistic composition of the layers were investigated. The coefficient of volume scattering, the intensity of the layer, and their diurnal and seasonal variations due to the migrations of the fish, crustaceans, and plankton are discussed. The possibility of using echo sounder data for evaluating the influence of sound scattering layers on the underwater acoustic wave propagation was described in detail. It was felt that the echo sounder observations cannot be used directly, but that the data can be extremely useful in determining the distribution of sound scattering layers in the oceans. Biological samplings of the smaller organisms and fish were made at different layers, from phytoplankton to bathypelagic fish, prawns and small squids. No attempt to catch larger animals was made. The difficulties encountered in utilizing the data are mentioned, and it was pointed out that the scattering coefficient and intensity are not yet able to be computed. It was concluded that the principal scattering frequencies for a particular layer can be estimated on the basis of the results of the catches. N.E.N.

N66-28648# Joint Publications Research Service, Washington, D. C.
SOUND-SCATTERING LAYERS AS INDICATORS OF INTERNAL WAVES IN THE OCEAN
Yu. G. Chindonova and V. A. Shulepov *In its* Recent Develop. in Soviet Oceanog. 17 Feb. 1966 p 17–24 refs (See N66-28646 16-13) CFSTI: $2.00

The use of sound scattering layer data as indicators of internal waves in the ocean is discussed. Since the pelagic animals, whose movement is dependent upon temperature, will move with the water particle in the internal vertical waves, the scattering from them will give an indication of the internal wave motion. Data was obtained during several continuous days on the vertical change of layers closely situated to one another, and the tabulated data is presented. The data, taken in the open ocean, differ from data previously obtained in coastal and shallow parts of the ocean by large amplitudes of the oscillations and their deeper position. It was concluded that the sound scattering layer data may give information on the amplitudes of internal waves and the depths of their propagation, and may also give additional information on the ecology of pelagic animals in the ocean. N.E.N.

N66-28795*# Illinois Univ., Urbana. Coordinated Science Lab.
A SURVEY OF GROUPS AND INSTRUMENTATION CONCERNED WITH MEASUREMENT OF THE NEUTRAL COMPOSITION OF THE UPPER ATMOSPHERE (1963)
In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 101–112 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

Aeronomy research efforts are reviewed, and details are given on a survey conducted to assess the research being undertaken in laboratories to develop instrumentation for mass spectrometer measurements of the neutral composition in the atmosphere. Findings indicate that several types of quadrupole mass spectrometers are being constructed: for use at altitudes greater than 100 km where no differential pumping is required; to be used at 70 km with differential pumping; and as an ion mass spectrometer. Details are given on double focusing spectrometers, a helium mass spectrometer to measure low helium concentration, and on an omegatron to measure neutral nitrogen temperature in the upper atmosphere. N.E.N.

N66-28798# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

STRENGTH STUDIES ON ANTARCTIC SEA ICE

George Hendrickson and Robert Rowland Jul. 1965 26 p refs (CRREL-TR-157; AD-622773) CFSTI: HC $2.00/MF $0.50

The strength of sea ice was studied at McMurdo, Antarctica, during two successive field seasons. Three hundred tensile tests were made on continuous core samples taken at various locations on ice aged 1 year, 2 years, and more than 5 years. Salinity profiles were obtained for each core. A relationship between strength σ(kg/sq cm) and volume of brine cavities v (%), as suggested by Assur, adequately represents the data of brine volumes less than 0.400; $\sigma = 29.1 - 48.0\ v^{1/2}$. The constants agree satisfactorily with values obtained previously for Arctic sea ice, the value of σ for very low brine volume approaching the value for fresh-water ice. The model on which the above expression is based apparently breaks down at high brine volumes.. Author (TAB)

N66-28799# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ERROR STUDY OF A WORLDWIDE SATELLITE TRIANGULATION NET

Edna L. Lortie Jan. 1966 73 p refs (BRL-R-1310; AD-630781) CFSTI: HC $7.60/MF $0.75

A proposed three-dimensional geodetic reference system, consisting of 36 stations so situated on the surface of the earth as to form a closed system of approximate equilateral triangles surrounding the globe, is studied in an attempt to find out to what degree of accuracy the station positions can be determined when triangulating the corresponding station coordinates by photogrammetric techniques. The polyhedron of the spatially oriented triangles is formed by photographing a high altitude satellite against the star background. The triangulation method depends on applying analytical photogrammetric techniques to satellite observations where the satellite serves as a high altitude auxiliary triangulation target point. Numerical analyses on the whole net and portions of it are presented from which the problem of error propagation and the influence of the number of baselines can be studied. Author (TAB)

N66-28832*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

RESEARCH ON ELEMENTAL ABUNDANCES IN METEORITIC AND TERRESTRIAL MATTER Summary Progress Report, 1 Sep. 1964–31 Aug. 1965

R. A. Schmitt 31 Aug. 1965 20 p refs (Contract NASw-843) (NASA-CR-75812; GA-6642) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Abundances of seven elements, (Na, Sc, Cr, Mn, Fe, Co, and Cu), were determined by the technique of instrumental neutron activation analysis in 25 individual chondrules separated from the Type IIIA carbonaceous chondrite Ornans; 40 chondrules from the L-group chondrite Saratov; 20 chondrules from the H-group chondrite Richardton; and 20 chondrules from the H-group chondrite Miller. The ratios of the average abundances in chondrules to abundances in the respective carbonaceous Types IIIA and IIIB chondrites have been plotted; other figures represent correlations of Fe–Co and Co–Cu for Type IIIA and IIIB carbonaceous and other chondrites. It was pointed out that abundances of the seven elements were easily determined because convenient radionuclides (2.56-hr to 5.3-yr half-lives) of these elements are generated in meteoritic stony matter by thermal-neutron activation and can be measured by gamma-ray scintillation spectrometry. R.L.I.

N66-28857# Royal Aircraft Establishment, Farnborough (England).

THE SEMI-ANNUAL VARIATION IN UPPER-ATMOSPHERE DENSITY, AS REVEALED BY SAMOS 2

D. G. King-Hele Mar. 1966 19 p refs (RAE-TR-66076) CFSTI: HC $1.00/MF $0.50

A semi-annual variation in upper-atmosphere density, with maxima in April and October, and minima in January and July, was discovered in 1960, and has been generally accepted as a feature of the upper atmosphere at heights of 200–800 km. Recently it has been suggested that the semi-annual variation may be a disguised effect of latitude: this hypothesis can best be tested by analysing the orbit of a polar satellite in a near-circular orbit. Samos 2 is such a satellite and its orbit is analyzed in this paper. The results show a clear semi-annual variation in air density at a height of 500 km in 1961–2, with the maximum density (October) exceeding the minimum (January and July) by a factor of 2. The April maximum is about 20% lower than that in October. Latitude has no influence on the result. Author

N66-28989# Iowa State Univ. of Science and Technology, Ames.

SURVEY OF ENVIRONMENTAL RADIOACTIVITY

Milo D. Voss Dec. 1965 38 p (Contract W-7405-ENG-82) (IS-1320) CFSTI: HC $2.00/MF $0.50

The environmental monitoring program is the preoperational program for the Ames Laboratory Research Reactor (ALRR). The pre-operational environmental program consists of gross alpha and beta determinations of air, soil, vegetation, river water, bottom sediment, precipitation, and well-water samples. This report includes data for the period January 1, 1965 to December 31, 1965. The data indicate that the ALRR has not been a contributor to environmental radioactivity in the Ames area. The conclusion is reached that radioactivity levels recorded represent background conditions from atmospheric fallout and naturally occurring radioactivity. Author (NSA)

N66-29114# Atomic Weapons Research Establishment, Aldermaston (England).

GEOMAGNETIC MICROPULSATIONS

D. Orr (Makerere Univ.) Feb. 1966 21 p refs (AWRE-O-9/66) HMSO: 3s 3d

A survey is presented of various proposed models of the magnetosphere and experimental observations which a successful model must be able to explain. Observations of electromagnetic and hydromagnetic waves which occur within the magnetosphere in the period range for 1/5 s to 10 min are discussed. Finally proposals are made for experiments which can be performed using data from UKAEA field stations. Author (NSA)

N66-29126# Northwestern Univ., Evanston, Ill. Dept. of Geology.

THE FOURIER SERIES MODEL IN MAP ANALYSIS

William R. James Apr. 1966 44 p refs (Contract Nonr-1228(36)) (TR-1; AD-631716) CFSTI: HC $2.00/MF $0.50

During the past several years the double Fourier series has been applied to the analysis of contour-type maps as an alternative to the more commonly used polynomial model. The double Fourier series has high potential in the study of areal variations, inasmuch as a succession of trend maps based on decreasing wavelengths of the harmonic function can readily be prepared. Such maps are useful in distinguishing broad-scale regional effects from smaller-scale local fluctuations superimposed on the larger-scale trends. This report reviews some aspects of Fourier analysis, and shows the relation of the Fourier model to the general linear model in terms of the coefficient array and the Z^2 array that expresses the variance contributions of the individual coefficients. The analogy between trend analysis and analysis of variance designs (nested models and row-column models) is pointed out, and it is shown that the double Fourier Series can be used to summarize the directional properties of areally-distributed data. An Appendix lists computer programs for double Fourier analysis of gridded map data, and for continuous symbol maps of double Fourier trends and residuals. Author (TAB)

N66-29140# New York Univ., N. Y. Lab. for Electroscience Research.

A MATHEMATICAL MODEL FOR THE ANALYSIS OF CONTOUR-LINE DATA

Stephen P. Morse Oct. 1965 54 p refs

(Grant AF-AFOSR-24-65)

(TR-400-124; AFOSR-66-0694; AD-631669) CFSTI: HC $3.00/MF $0.50

This paper develops a mathematical model for the study of contour line data. Formal definitions are given for the various classes of contour lines found on a contour map. The concept of cliff lines is introduced and the properties of both contour lines and cliff lines are investigated. The objective of the paper is to lay a foundation for the development of algorithms that will facilitate the digital computer solution of problems involving contour line data. Author (TAB)

N66-29142# Naval Weapons Lab., Dahlgren, Va.

DETERMINATION OF THE EARTH'S GEOID BY SATELLITE OBSERVATIONS

Richard J. Anderle 26 Mar. 1966 41 p refs

(NWL-2027; AD-631212) CFSTI: HC $4.60/MF $0.50

Determinations of the geoid made by different authors have differed by more than forty meters in some geographic locations. The authors differed in the observations employed in the number of gravity coefficients they determined, and in a number of details in the method of solution. Experiments conducted with Doppler observations on satellites have shown moderate variations (rarely as much as 30 meters) in the geoid determined if the number of satellite orbital inclinations employed is reduced by one. Reduction of the number of gravity parameters used to represent the geoid also resulted in moderate variations in the principal geoid features, except under special circumstances which are described. Reducing the number of weeks of observations did not produce deviations greater than 25 meters. However, reducing the number of observing stations in addition resulted in distortions of the computed geoid which reached 100 meters. It appears that the most recent geoid heights determined from satellite observations are correct to about 20 meters at any location and that observational data being obtained and techniques of computation being utilized should improve the accuracy to 10 meters or better. Author (TAB)

N66-29177# Naval Oceanographic Office, Washington, D. C. Hydrographic Surveys Dept.

GEOPHYSICAL PROFILES IN THE NORTHEASTERN ATLANTIC OCEAN AND THE MEDITERRANEAN SEA, 1962–1963

D. E. Frankowski 1966 49 p

(H-2-66; AD-631745) CFSTI: HC $4.60/MF $0.50

Magnetic, gravity, and bathymetric data collected on an opportunity basis aboard three ships along a total of 4450 miles of track in the Northeastern Atlantic Ocean and the Mediterranean Sea are presented in profile form. Descriptions of the survey operations, control, instrumentation, and data processing provide information for further evaluation and analyses. Author (TAB)

N66-29187# New York Univ., N. Y. Lab. for Electroscience Research.

ANALYSIS OF A CONTOUR MAP ON A CLOSED SURFACE

Stephen P. Morse Sep. 1965 39 p refs *Its* Tech. Rept.-400-123

(Grant AF-AFOSR-24-65)

(AFOSR-66-0693; AD-631670) CFSTI: HC $2.00/MF $0.50

The various components of a contour map are defined, and a point of view is introduced that aids in developing insight into the properties of contour maps. Contour lines are the lines of intersection of a surface with reference surfaces. The contour lines can be classified into four classes: positive, negative, maximum, and minimum. If the surface is closed, such as the Earth's surface, positive and negative contour lines are always closed curves. Where the surface is perpendicular to the reference surfaces, a cliff is formed. A cliff line on a contour map is characterized by a merger of different contour lines. There is a graphical technique for determining where the various contour lines enter and leave a cliff line. A method exists for truncating the contour map so that it covers only a portion of a closed surface and still maintains the closed-curve property of contour lines. By defining an outer boundary, one is able to talk about the interior and exterior of those contour lines that are closed curves. Lines of slope are lines that are everywhere perpendicular to the contour lines. Slope contour lines are contour lines for the slope of the surface. The former is concerned with the direction of the gradient, the latter with its magnitude. Author (TAB)

N66-29234# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

NEW APPROACHES TO COMPUTING GEOIDAL HEIGHTS AND THEIR COMPARISON TO THE CLASSICAL GEODETIC METHOD

F. T. Heuring Apr. 1964 12 p refs

(Contract NOw-62-0604-c)

(TG-564; AD-631827) CFSTI: HC $1.00/MF $0.50

Calculations are given for methods of ascertaining geoidal heights developed by Guier and the author; and these in turn are compared with the classical geodesy approach as used by Kaula. A brief introduction to the formulation of the earth's mass potential is presented. All of the methods yielded values within a range of five meters for a particular point. Guier's values are closer (± two meters) than the author's (± five meters) to Kaula's values; probably because Guier's method is conceptually similar to Kaula's. For purposes of computation, Guier's method is recommended because it involves less

calculations and inputs than Kaula's and includes no iterations as does the author's method. Values obtained from calculations using various harmonic coefficients are tabulated. L.S.

N66-29253# Emmanuel Coll., Boston, Mass. Research Language Center.
A METHOD FOR CALCULATING THE VERTICAL MOTIONS AND THE DISTRIBUTION OF THE HEAT SOURCES AND SINKS IN THE STRATOSPHERE OVER THE NORTHERN HEMISPHERE IN JANUARY 1958
Shwu-ching Sun Bedford, Mass., AFCRL, Mar. 1966 26 p refs Transl. into ENGLISH from Acta Met. Sinica (Peking), v. 34, no. 4, 1964 p 397–408
(Contract AF 19(628)-5073)
(EMM-65-19; AD-632406) CFSTI: HC $2.00/MF $0.50

A new method has been proposed for the computation of the vertical motions in the stratosphere by integrating the vorticity equation with respect to pressure downward from the upper boundary of the stratosphere. This method is shown to be superior to the one based on the integration of the same equation upward from the surface of the ground. Using the more reliable values of vertical motions obtained by the former method, the mean non-adiabatic heating in the stratosphere (10–100 mb) is then computed by means of the first law of thermodynamics. The basic data used are taken from the monthly mean pressure and air temperature charts for the stratosphere of the northern hemisphere for January 1958. It is found that for the middle levels of the stratosphere, the distribution of heat sources and sinks is characterized by large-scale features, similar to those of the pressure field at these levels. The ultra-long waves (with wave number of one or two) are far more predominant than waves of other scales. The geographical distribution of heating and cooling in relation to the pressure systems is also discussed. Author (TAB)

N66-29272# Aerospace Corp., San Bernardino, Calif. Weapon Systems Div.
AN ESTIMATE OF THE UNCERTAINTY IN THE ADOPTED VALUE OF GRAVITY AT ABSOLUTE STATIONS
G. A. Reams and A. J. Gregory Mar. 1966 36 p refs
(Contract AF 04(695)-669)
(TR-669(S6925-63)-1; BSD-TR-66-117; AD-632353) CFSTI: HC $3.60/MF $0.50

A determination of the uncertainty in the magnitude of gravity assigned to various absolute stations is presented in this report. Accurate estimates of these uncertainties are essential in design and guidance accuracy studies for ballistic weapon systems. A review of the literature on absolute and relative gravity measurements has been performed. The findings of this review indicate that at present there is some doubt about the value of gravity to adopt for each of the absolute stations and a corresponding doubt concerning the uncertainty. Using published gravity data, various adjustments have been studied. The computational procedure used consists of a simultaneous determination of the value of gravity at each absolute station through a least-squares adjustment of the absolute and relative gravity observations. This procedure yields an adjusted value of gravity and an estimate of the uncertainty at each station. Estimates of uncertainty are computed assuming that the errors in the data are random and also assuming that part of the error is systematic. Author (TAB)

N66-29283# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
FROST-HEAVING PRESSURES
P. Hoekstra, E. Chamberlain, and A. Frate Oct. 1965 19 p refs
(CRREL-RR-176; AD-626175) CFSTI: HC $1.00/MF $0.50

Upon freezing a saturated soil in an open system from the top down, a considerable pressure develops. The pressure is the result of the surface energy of a curved ice-water interface. The curvature of the interface is necessary for ice to proliferate through the soil pores. The curvature is related to the pore size distribution of the soil. The test chamber is designed to minimize the friction of the soil with the wall. An accurate control of heat removal is obtained by thermoelectric cooling. A load cell placed on top of the sample is used to measure the pressure developed and at the same time prevents heaving of the sample. By measuring the pressure on a layered sample, it can be shown that the pressure develops at the freezing front. The results on several soils indicate that the maximum pressure that develops has a characteristic value for each soil. For each soil used, the water content versus tension curve is given and the maximum pressure is related to this curve. Author (TAB)

N66-29309# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
MODELING THE TUNGUS METEORITE EXPLOSION
I. T. Zotkin and M. A. Cikulin May 1966 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, 1966 p 1, 59–62
(T-458-R) CFSTI: HC $1.00/MF $0.50

Experiments were conducted on a model forest of the Tungus meteorite tree fall to explain the eccentric epicenter and pattern of the fallen trees. In the modeling experiments, a ballistic wave was produced by exploding a detonating fuse with a linear explosive energy of 6.3×10^6 erg/cm and a detonation velocity of 7–8 km/sec. The explosive energy was increased by adding an end charge. The fuse was fixed in a sloping position and ended at a certain height above the model forest. Results show that the Tungus tree fall can be explained by the wave of an axial explosion (ballistic wave) and the projection of the axis is defined by the shape of the tree fall field. The reinforcement of the linear explosive energy in the terminal part of the trajectory is comparatively small. It would correspond to a multiplication by a few times of the cross sectional area of the moving body, an increase that is interpreted as the breakup of the meteorite. R.N.A.

N66-29323# International Training Centre for Aerial Survey, Delft (Netherlands).
PUBLICATIONS OF THE INTERNATIONAL TRAINING CENTRE FOR AERIAL SURVEY: REVERTERA NUMBER Special Publication No. 2
L. U. de Sitter, J. F. M. Mekel, P. Buringh, A. P. A. Vink, H. Th. Verstappen et al 1965 60 p refs
(B33) CFSTI: HC $3.00/MF $0.50

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5. THE STRUCTURAL SIGNIFICANCE OF A FRACTURE PATTERN OBSERVED IN THE MONTSECH AREA Caesar Voute p 36–40 refs

6. TERRESTRIAL PHOTOGRAMMETRY FOR GEOLOGICAL PURPOSES J. F. Savage p 41–53 refs

N66-29347*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

ELECTRON TEMPERATURE AND DENSITY FLUCTUATION IN THE DAYTIME IONOSPHERE

J. Doupnik and J. S. Nisbet [1965] 17 p refs Presented at NATO Advanced Study Inst. on Electron Density Profiles in the Ionosphere and Exosphere, Finse, Norway Submitted for Publication

(Grant NsG-134-61)

(NASA-CR-57304) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Large elecron temperature fluctuations have been observed in the F region during the day using incoherent scatter measurements at Arecibo. The behavior is quite variable from day to day. When the fluctuations occur large changes in the equilibrium density distribution result and the electron densities in the layer change rapidly. The relationship between the electron densities, thermal energies and heat transport rates during these events is discussed. Author

N66-29350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSITIVE ION COMPOSITION IN THE MAGNETOIONOSPHERE OBTAINED FROM THE OGO-A SATELLITE

Harry A. Taylor, Jr., Henry C. Brinton, and Charles R. Smith 29 Jun. 1965 46 p refs Submitted for Publication

(NASA-TM-X-56722) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Results from the OGO-A positive ion spectrometer are presented for the period September 23 through December 10, 1964. Thermal hydrogen and helium ion distributions extend from 1500 to 30,000 km. The density obtained for H^+ at 2000 km is 10^3 ions/cm^3 and the He^+ concentration is 1% of H^+ over most of the altitude range. While the concentration and distribution of H^+ observed at lower altitudes agrees with theoretical models, the upper altitude profiles show departures from existing predictions. Evidence is presented which indicates that ion diffusion is controlled by the geomagnetic field and that ions are distributed in a belt-like region which exhibits a sharp gradient resulting in a plateau at its outer boundary which is characterized by a reduction in H^+ and He^+ concentrations of a factor of 10 or more. The ion belt is observed to expand and contract over an altitude range of 9000 to 30,000 km in an inverse relationship with the magnetic activity index A_p. There is a correlation between these results and the knee whistler observations as well as with high altitude ionization gradients observed from other satellites. Author

N66-29358*# National Aeronautics and Space Administration, Washington, D. C.

ON THE INTENSIFICATION OF THE EMISSION OF THE NIGHT GLOW IN ZODIACAL LIGHT [OB USILENII EMISSIONNYKH LINIY SVECHINIYA NOCHNOGO NEBA V ZODIAKAL'NOM SVETE]

M. G. Kerimov Nov. 1963 6 p refs Transl. into ENGLISH from Izv. Astrofiz. Inst., Akad. Nauk Kaz. SSR (Alma Ata), v. 5, no. 7, 1957 p 120–122

(NASA-TT-F-8713) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Investigation of the intensification of the emission of the nightglow in zodiacal light indicated that the lines of the nightglow are intensified in zodiacal light but that a greater number of observations must be made in order to explain their magnitude. In general, the intensification of the 5577 Å line of the nightglow is 15%. P.V.E

N66-29367*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

FLIGHT-TEST RESULTS OF GAMMA RAY SCATTERING AS A TECHNIQUE FOR AIR-DENSITY MEASUREMENTS

Henry G. Reichle, Jr. [1965] 11 p Presented at the 2d Conf. on Direct Aeronomic Meas. in the Lower Ionosphere, Ill. Univ., Urbana, 27–30 Sep. 1965

(NASA-TM-X-56837) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A rocket payload carrying a 24 Curie cerium 144 gamma radiation emitting source and a sodium iodide scintillation detector separated by a suitable shield, was flight tested to investigate the feasibility of using gamma ray scattering as a technique for air density measurement. The volume of air for which the actual characteristics were measured was located outside the vehicle flow field. The geometry was arranged such that the detector counted only photons scattered by the air at some predetermined distance from the vehicle. This count rate was related to the air density, and was telemetered back. A schematic diagram of the flight payload is depicted. Prior to the test, the payload was calibrated in a 60-ft diameter vacuum sphere. Three Arcas rockets (one having a temperature sensing payload, and two having Robin balloon sensing payloads) and two radar tracked radiosonde balloons were flown in support of the firing. These supporting data agreed with the 1962 U.S. Standard Atmosphere Data Compilation. A plot of the telemetered count rate data as a function of the vehicle altitude; and a plot of the adjusted data in which the average count rate for the period above 50 km is subtracted, are depicted. L.S

N66-29427*# National Aeronautics and Space Administration, Washington, D. C.

SPECTRAL, ELECTROPHOTOMETRIC, AND RADAR RESEARCHES OF AURORAE AND AIRGLOW [SPEKTRAL'NYYE, ELEKTROFOTOMETRICHESKIYE I RADIOLOKATSIONNYYE ISSLEDOVANIYA POLYARNYKH SIYANIY I SVECHENIYA NOCHNOGO NEBA]

Mar. 1962 59 p refs Transl. into ENGLISH from Statei (Moscow), no. 6, 1961 p 1–42

(NASA-TT-F-8183) CFSTI: HC $3.00/MF $0.50 CSCL 04A

This is the sixth anthology on spectral, electrophotometric, and radar researches of auroras and airglow published under the auspices of the IGY Committee of the U.S.S.R. Academy of Sciences. Each article in this collection is abstracted and referenced. M.P.S

N66-29505# Royal Aircraft Establishment, Farnborough (England).

UPPER-ATMOSPHERE DENSITY, DETERMINED FROM THE ORBITS OF COSMOS ROCKETS

D. G. King-Hele and Eileen Quinn Feb. 1966 24 p refs

(RAE-TR-66064) CFSTI: HC $1.00/MF $0.50

Observational values of air density at heights of 150 to 230 km at times of low solar activity are still sparse. In this paper the orbits of 32 Cosmos rockets and 2 other satellites are examined, to obtain new values of air density from the orbital changes. An improved method is used for satellites very near the ends of their lives. The results strengthen the previous picture of the day-to-night variation in air density at height

of 200 to 300 km, and indicate a substantial variation of density with height down to 170 km at times of low solar activity. The results at heights between 160 and 200 km suggest that recent theoretical models do not allow a large enough day-to-night variation in density. The analysis also shows, incidentally, that the mass/area ratios of the Cosmos rockets with inclinations of 65° differ appreciably from the values for those with inclinations of 49°. Author

N66-29509*# Bellcomm, Inc., Washington, D. C.
RELATIONSHIPS BETWEEN GEOGRAPHIC AND INERTIAL COORDINATES OF POSITION
W. G. Heffron and S. B. Watson 17 Mar. 1966 20 p refs
(Contract NASw-417)
(NASA-CR-75926; TM-66-2012-1) CFSTI: HC $1.00/MF $0.50 CSCL 08E

Relationships between geographic (longitude, geodetic latitude, altitude) and inertial (x, y, z) coordinates of position are examined and computational techniques are given. The distinctions between geodetic latitude, geocentric latitude and geocentric declination are shown. Errors resulting from misuse of these angles are given. Author

N66-29544*# Geological Survey, Washington, D. C.
GEOLOGIC MAP OF THE PISGAH AND SUNSHINE CONE LAVA FIELDS
William S. Wise (Calif. Univ., Santa Barbara) 10 Mar. 1966 48 p refs
(NASA Order R-146)
(NASA-CR-74005) CFSTI: HC $2.00/MF $0.50 CSCL 08G

Geologic maps are presented which show the distribution of the Pisgah and Sunshine Cone lavas (and their fragmental equivalents) in the vicinity of Pisgah Crater, San Bernardino County, California. The maps present the geology at a scale of 1:24,000 on four sheets; sheet five is a 1:12,000 scale detailed map of the Pisgah Crater area. Also included is a summary of the geologic history of the Pisgah and Sunshine Cone lava fields. R.N.A.

N66-29556# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 134
24 Jun. 1966 96 p Transl. into ENGLISH from Russian
(JPRS-36186; TT-61-11147-134) CFSTI: $3.00

News items and abstracts of Soviet Bloc scientific articles in the fields of astronomy, meteorology, terrestrial geophysics, and upper atmosphere and space research are presented, and complete bibliographic material is given. Reports in the field of astronomy cover aerosol component of Martian atmosphere, carbon dioxide absorption bands in Venusian spectrum, radio emission of the eclipsed moon, and beaded structure of star trails. Topics reviewed in the field of meteorology include artificial dispersion of clouds and fogs over airports, yearly strontium 90 fallout in polar regions, worldwide evaporation maps, radio echo signals from clouds and precipitation, and dissipation of energy by anisotropic turbulence. Some of the subjects covered under terrestrial geophysics are stereophotography from a ship, phase response of an electrodynamic seismic detector, frequency phase analysis of seismic waves, and spectral analysis of seismic oscillations. Satellite and rocket observations of solar spectrum, anomalous polar cap absorption, horizontal drift in ionosphere during solar eclipse, and mechanism of diurnal variation of cosmic rays are included under upper atmosphere and space research. L.E.W.

N66-29586# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADJUSTMENT OF SPACE TRIANGULATION
G. A. Ustinov 20 Dec. 1965 15 p refs Transl. into ENGLISH from Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 2, 1963 p 19-24
(FTD-TT-65-1190/1+4; AD-627070) CFSTI: HC $1.00/MF $0.50

The method of adjustment in space triangulation is briefly reviewed, its shortcomings are pointed out, and a revised method is proposed. The method uses earth satellites as geodesic signals simultaneously observed from different points on the earth's surface. The shortcomings are identified as (1) the necessity of simultaneous observation at not less than three points, and (2) the cumbersomeness of processing the voluminous results. The modification consists of simultaneously determining the topocentric coordinates and positions of the satellite from two points. Equations for the coordinates are formulated, and the problem of adjustment is solved using the least squares method. It is pointed out that the revised method involves solving a system of 84 normal equations instead of 984. Other advantages are mentioned. N.E.N.

N66-29722*# National Aeronautics and Space Administration, Washington, D. C.
CLASSIFICATION OF IRON METEORITES BY STRUCTURE [O KLASSIFIKATSII ZHELEZNYKH METEORITOV PO STRUKTURE]
A. A. Yavnel' May 1966 18 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 26, 1965 p 140-145
(NASA-TT-F-10130) CFSTI: HC $1.00/MF $0.50 CSCL 08D

A structural classification of siderolites into altered and unaltered meteorites, based on chemical composition of the meteoritic iron and the conditions of its cooling, is proposed. As basic classifying feature, the mutual orientation of the crystals of the α-phase is used, with further subdivision into normal and granular hexahedrites; coarse-to-fine structured octahedrites; an intermediary hexa-octahedrite group; altered and unaltered ataxites. Iron-nickel phase diagrams and distribution histograms are used for a tabulated classification according to original structure. Author

N66-29729*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY INVESTIGATION OF THE MINERALOGICAL COMPOSITION OF THE STONE METEORITE VENEROVA [PREDVARITEL'NOYE ISSLEDOVANIYE MINERALOGICHESKOGO SOSTAVA KAMENNOGO METEORITA VENGEROVO]
I. A. Yudin Jun. 1966 12 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 84, no. 1, 1952 p 123-126
(NASA-TT-F-10213) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Composition of the meteorite is analyzed by size, shape, structure and ore (or silicate) content. Etching, microscopy and spectral and chemical analysis are used. Author

N66-29743*# Ohio State Univ. Research Foundation, Columbus.
THE DETERMINATION AND DISTRIBUTION OF PRECISE TIME

Hans D. Preuss Apr. 1966 221 p refs *Its* Rept.-70
(Contract NSR-36-008-033)
(NASA-CR-76007) CFSTI: HC $6.00/MF $1.25 CSCL 08E

Precise time, distributed by means of radio broadcasts, is required for two similar geodetic tasks: astronomic position determination; and observations of artificial satellites for geodetic purposes. The aim of this report is to assimilate under one cover the various phases of the determination and distribution of precise time. The determination of time has become a specialized field of astronomy and is presented in Chapter II. Timekeeping and the basis of constant frequency is discussed in Chapter III. Chapter IV deals with variations in the time systems which are connected to the rotation of the Earth, and with the corrections that have to be applied to observed time. The distribution of precise time through radio broadcasts is presented in Chapter V. Finally, the manner in which the geodesist ought to use distributed time and the corrections that have to be applied to received radio time signals are discussed in Chapter VI. Author

N66-29782# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ENVIRONMENTAL MONITORING
J. F. Honstead and J. K. Soldat 25 Mar. 1965 73 p refs Presented at Inter-Regional Advanced Training Seminar on Radioactive Waste Management, Tokai-Mura, Japan, 4–15 Oct. 1965 Submitted for Publication
(Contract AT(45-1)-1830)
(BNWL-SA-465) CFSTI: HC $3.00/MF $0.75

The environmental radiation monitoring program at the Battelle Memorial Institute Pacific Northwest Laboratory, Richland, Washington is described in detail. Criteria for environmental monitoring programs are reviewed and methods used for pre-operational surveys, emergency surveys, operational surveys, radiological monitoring of the Columbia River and the atmosphere are described. Exposure pathways that must be combined to assess the total exposure of employees and the public are discussed. NSA

N66-29786# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS. REPORT I: ITERATION PROCEDURE FOR SATURATED ELASTIC POROUS MATERIAL
John T. Christian Jun. 1965 54 p refs *Its* Contract Rept.-13-29; Soils Publ.-184 Available from Army Engr. Waterways Expt. Station, Vicksburg, Miss.
(Contract DA-22-079-ENG-427)
(R65-46; AD-632364) CFSTI: HC $0.75/MF $0.50

A program for the IBM 7040 computer was developed to provide the stress and displacement fields for an elastic porous material under conditions of plane strain with rectangular boundaries and force or displacement controlled loading. The program uses a lumped parameter model of the material and solves the problem by an iterative technique. Options are provided for solving drained cases, in which volume change occurs and no pore pressures develop, and undrained cases, in which no volume change occurs and pore pressures do develop. The output includes a listing of force, stress, and displacement fields and a graphical array of normalized stress fields for total stresses, effective stresses, and pore pressures. The results of a sample problem are shown. Author (TAB)

N66-29873# Joint Publications Research Service, Washington, D. C.
ON CALCULATING THE VERTICAL TEMPERATURE PROFILE IN THE SEA
S. V. Kochetov and K. S. Pomeranets 29 Jun. 1966 18 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 86, 1965 p 144–152
(JPRS-36256, TT-66-32689) CFSTI: $1.00

A numerical method was used to solve a linear equation of thermal conductivity with a temperature coefficient of thermal diffusivity that was variable in depth and time. Several models of this coefficient were used in the calculation and are illustrated by graphs. Equations were derived to describe the vertical distribution of heat in the sea. The results of the calculation were compared with observations at the Utyo lightship in the Baltic Sea. It was indicated that analogous calculations of the vertical temperature profile of water can be performed in any region of the sea, considering the initial and boundary data. In a limited inland sea, it was found that the data, like the form of the vertical temperature profile, were quite close for different regions. The results supported the efficiency of numerical methods for calculating the heat processes in the sea. L.E.W.

N66-29875# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 135
30 Jun. 1966 99 p refs
(JPRS-36285; TT-61-11147-135) CFSTI: $3.00

News items and abstracts of scientific articles from publications issued by Sino–Soviet Bloc countries are presented. Areas of research included are: astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and outer space. S.F.

N66-29885# International Geophysical Year World Data Center A, Washington, D. C.
CATALOGUE OF DATA IN WORLD DATA CENTER A: AIRGLOW, IONOSPHERE, AURORA (INSTRUMENTAL), AURORA (VISUAL), COSMIC RAYS, GEOMAGNETISM, SOLAR ACTIVITY, 1 JULY 1957–31 DECEMBER 1965
Mar. 1966 158 p refs Sponsored by NSF Supersedes N65-23883 13-13

Airglow data, the results of photometric observations, are listed for zenith intensities. Vertical incidence soundings of the ionosphere by the pulse technique are recorded, as are daily graphical quarter-hourly f-plots of critical frequencies, monthly tables of hourly values, and monthly medians for various parameters. Ionospheric electron density is catalogued, and monthly tables are inventoried for ionospheric absorption by several measuring methods. For ionospheric drift, values registered are obtained by radio observations on drifting meteor trails, by fading intercomparison at close-wavelength-spaced antennas, and from observations of characteristic widely-spaced reflection features. With regard to atmospheric radio noise measurements, it is noted that most stations observe on several frequencies in the range of .013 to 20 Mc; monthly tables of hourly values of the noise power in dB for each frequency measured are tabulated. Observations are entered on whistlers and very low frequency noise observations. Miscellaneous measurements on observations cover: rocket and satellite source measurements, auroral radar, back and forward scatter, scintillations and other special projects. R.L.

N66-29902# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
THE ELASTIC CONSTANTS, STRENGTH AND DENSITY OF GREENLAND SNOW AS DETERMINED FROM MEASUREMENTS OF SONIC WAVE VELOCITY Technical Report, 1963–1964
James L. Smith Nov. 1965 25 p refs
(CRREL-TR-167; AD-632357) CFSTI: HC $2.60/MF $0.50

The measurement of sonic wave velocities on undisturbed samples of Greenland snow was accomplished using piezoelectric transducers in conjunction with a soniscope which provided the exciting source and the time measuring device. These velocity measurements were correlated with density determinations, crushing strength tests, and the elastic constants of the Greenland snow samples for a density range of 0.4 to 0.9 g/cc. Empirical formulae were derived that present the density, crushing strength, and the elastic constants as functions of sonic wave velocity. Author (TAB)

N66-29934# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
PULSATIONS OF BEAT TYPE IN THE ELECTROMAGNETIC FIELD OF THE EARTH (ACCORDING TO OBSERVATIONS AT IRKUTSK)
P. A. Vinogradov Feb. 1966 14 p refs Transl. into ENGLISH from Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), no. 11, 1962 p 114–124
(T-443-R; AD-632259) CFSTI: HC $1.00/MF $0.50

The report discusses beat-type pulsations (pearl pulsations) in the terrestrial electromagnetic field, and the relationship between the excitation of these pulsations and certain electromagnetic phenomena in the upper atmosphere. The results presented were obtained on the basis of four years of observation. Author (TAB)

N66-29941# Hawaii Inst. of Geophysics, Honolulu.
EARTHQUAKE EPICENTER DETERMINATION USING Δ t DATA
George Pararas-Carayannis and James Sasser Dec. 1965 52 p refs
(Contracts Nonr-3748(01); Nonr-3748(03))
(HIG-65-16; AD-631847) CFSTI: HC $3.00/MF $0.50

Theoretical time differences in the arrival of p-waves at different seismic stations around the Pacific were compiled and plotted by digital computer and by hand. Time-difference curves were plotted for each pair of seismic stations; such curves will allow the quick determination of earthquake epicenters. The following seismic stations were used in the compilations: Honolulu, Hawaii; Tucson, Arizona; Hong Kong; College, Alaska; and Sitka, Alaska. Included in this report is a modified version of the spherical hyperbola program that was used in the compilation. Travel-time difference charts are included as appendices for all combinations of the seismic stations listed above. Author (TAB)

N66-29962# Army Electronics Labs., Fort Monmouth, N. J.
VARIABILITY OF ROCKET-MEASURED WINDS
Marvin J. Lowenthal Apr. 1966 28 p refs
(ECOM-2693; AD-632597) CFSTI: HC $2.00/MF $0.50

Variability of rocket winds has been investigated using as a statistic mean vector wind differences for various time intervals from less than one hour to 24- and 48-hour periods. In all cases the variability increases with height in the 30- to 80-km region. Using the method of least squares, a straight line is fitted to the data, which indicated no significant difference for easterly or westerly winds at any of the three locations: White Sands, Pacific Missile Range, or Atlantic Missile Range (now Air Force Eastern Test Range). The mean error between the regression line and the observed data is of the order of two meters per second. To improve the fit, a parabolic least squares fit was attempted, with a resultant mean error of approximately one meter per second. Further refinements are beyond the accuracies of the observations. Shorter period-variabilities increase as the square root of the time up to approximately eight hours. For longer periods there is little increase with time. The deviations in the winds are investigated to determine the character of the variations, and the contributions of the eddies to the total kinetic energy are examined in the light of wind resistance. Author (TAB)

N66-29965# Kiruna Geophysical Observatory (Sweden).
LATITUDINAL AND DIURNAL VARIATIONS OF THE IONOSPHERIC ELECTRON CONTENT NEAR THE AURORAL ZONE IN WINTER Scientific Report No. 11
Ludwik Liszka 7 Dec. 1965 12 p refs
(Contract AF 61(052)-678)
(AFCRL-66-223; AD-632264) CFSTI: HC $1.00/MF $0.50

The analysis of three month's observations of Faraday rotation observed on S-66 transmissions made at Kiruna Geophysical Observatory (ϕ=67.8°N, λ=20.3°E) is presented. The ionospheric electron content along the subionospheric path of the satellite was computed for almost 400 transits. Also effective slab thicknesses were calculated using critical frequency values from 6 Scandinavian stations, covering an interval of 10 degrees of latitude. Latitudinal and diurnal variations of the ionospheric electron content and the effective thickness were studied. The most striking feature of the latitudinal variation of the total electron content was a distinct minimum at the southern boundary of the auroral zone during winter night-time. This minimum coincides with the 'trough' observed by topside sounding satellites. Author (TAB)

N66-29982# Joint Publications Research Service, Washington, D. C.
A METHOD OF CALCULATING THE TEMPERATURE OF THE WATER IN THE ACTIVE LAYER OF THE WHITE SEA
N. Ya. Arsen'yeva 29 Jun. 1966 33 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 88, 1965 p 75–94
(JPRS-36254; TT-66-32687) CFSTI: $2.00

A method of calculating the mean temperatures of the wind mixing layer and of the entire active layer of the sea by the heat balance method, based on hydrometeorological data, is described. The relation between the variation in the thermal state of the active layer, the heat balance of the surface, and the advection by marine currents is presented. The application of the derived mean monthly temperature formula is limited to the geographical regions where heat advection by sea currents is comparatively small, and to those regions where the vertical distribution of the intensity of advective heat transfer is small. Calculations of the mean temperature for the entire active layer (0–100 m) and for its upper part (0–30 m) for June to October were performed for nine years throughout two White Sea regions. The observed and calculated data are presented in tables and graphs. It was concluded that the heat balance method for calculating mean temperatures is satisfactory, and may also be applied to other sea regions where heat advection is relatively small. N.E.N.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-28459# Endevco Corp., Pasadena, Calif.
PIEZORESISTIVE STRAIN GAGE ACCELEROMETERS INCREASE SPECTRUM OF SHOCK AND VIBRATION MEASUREMENT CAPABILITY
W. E. Wall *In* NRL The Shock and Vibration Bull. Feb. 1966 p 17-21 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

The period of interest spectrum concerns the measurement of constant acceleration with superimposed high frequency vibration or long duration shock pulses. The spectrum is defined and used to compare three types of shock measuring transducers: wire wound strain gauge, piezoelectric, and piezoresistive strain gauge. A typical piezoresistive strain gauge accelerometer is examined in detail for application, performance and user test results. Author

N66-28460# Weinschel Engineering Co., Inc., Gaithersburg, Md.
VIBRATION MEASUREMENTS USING A MICROWAVE INTERFEROMETER
C. F. Augustine and J. E. Ebert *In* NRL The Shock and Vibration Bull. Feb. 1966 p 23-31 (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

Vibration amplitudes as low as a fraction of a microinch at frequencies from dc to 20 kc were measured using a noncontacting microwave interferometer. A 35 Gc signal was used for sensing. This antenna focused the microwave energy to a diameter of about 0.15 inches on the target surface. Remote sensing, provided by the elliptical antenna, is particularly important if the target is in an oven, or vacuum, or is otherwise inaccessible. Changes in the phase of the reflected 35 Gc signal were detected and displayed either on a meter or an oscilloscope. The instrument was usable on either dielectric or metallic targets. The detected output signal is nearly linear even for amplitudes of 0.05 in. Absolute calibrations were obtained using as a standard a calibrated micrometer-driven phase shifter attached to one arm of the microwave phase bridge. A calibration technique was developed that could be used to determine the peak-to-peak displacement of each harmonic in a complex vibration. Author

N66-28461# Naval Air Test Center, Patuxent River, Md.
A WIDEBAND ABSOLUTE ACCELEROMETER CALIBRATOR UTILIZING A LASER FOR MEASURING VIBRATION DISPLACEMENTS
Robert B. Davis *In* NRL The Shock and Vibration Bull. Feb. 1966 p 33-36 (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

An absolute accelerometer calibrator utilizing a laser as the standard reference has been developed. The calibrator consists of a laser photodiode and appropriate electronic readout equipment, and is easy to operate with a direct digital readout for displacements greater than one-half of a wavelength. The present resolution of the prototype calibrator is one-tenth of a wavelength. The results of this development are discussed. Author

N66-28462# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
UNPUBLISHED ACCELEROMETER CHARACTERISTICS
Boris Mangolds *In* NRL The Shock and Vibration Bull. Feb. 1966 p 37-48 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

Accelerometer sensitivity to nonvibratory environments other than those generally known was evident during a study to investigate vibration data errors. The major areas of concern were determined to be base-strain sensitivity and temperature-transient sensitivity. Studies were initiated to establish the extent of vibration data error caused by these inherent accelerometer characteristics. This paper described the test methods used during these studies, the results obtained, and the conclusions and recommendations drawn from the results. Author

N66-28463# Kistler Instrument Corp., Clarence, N. Y.
NEW PRECISION CALIBRATION TECHNIQUES FOR VIBRATION TRANSDUCERS
Walter P. Kistler *In* NRL The Shock and Vibration Bull. Feb. 1966 p 49-54 (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

New techniques (which have been developed and tested over a period of years) are offered to advance the state-of-the-art vibration calibration. Rather than basing an accelerometer calibration on a vibration input, a high precision static method is used—similar to the calibration method used for pressure gages. The calibration value obtained is transferred to a quartz accelerometer. This transfer standard has its sensing element inverted under its top surface. Its element connects directly to the element of any commercial accelerometer. The reference accelerometer is vibrated; the outputs of both instruments are compared, thus, calibrating the unknown accelerometer. The vibration is used only as a means of generating a signal—it need not be purely sinusoidal nor need its amplitude or frequency be precisely known. Results of this method correlate closely with those obtained from the static loading method, impact-force shock calibration and servo accelerometer calibration. Author

N66-28464# Harry Diamond Labs., Washington, D. C.
OMNIDIRECTIONAL ACCELERATION SENSOR
A. J. Buschman, Jr. *In* NRL The Shock and Vibration Bull. Feb. 1966 p 55-60 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

An acceleration sensor that is independent of the direction of the acceleration vector has been developed for use in selection of a site for a manned lunar landing. This is accomplished by employing a triaxial accelerometer and a computer whose output is the square root of the sum of the squares of three orthogonal, acceleration-time signatures. The circuitry operates from a 20-V power supply drawing 10 mA and has a dynamic range of 1000. The triaxial accelerometer, computer, power supply, and telemetry can be packaged in a 3-in. diameter sphere. Author

N66-28465# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EFFECTIVE USE OF ACCELEROMETERS AS CALIBRATION STANDARDS
D. R. Workman *In* NRL The Shock and Vibration Bull. Feb. 1966 p 61-72 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

The paper covers in detail the methods used in obtaining maximum certainty with a conventional back-to-back calibration setup. Items discussed include: use and reduction of calibration data and determination of best curve response; verification of calibration systems using electrical, resonance, and absolute determination tests; and typical calibration mounts with their associated errors. Calibration data will be shown with an analysis of the expected system certainty. Author

N66-28466# Bureau of Naval Weapons Representative, Pomona, Calif. Metrology Engineering Center.
MEASUREMENT OF ACCELEROMETER TRANSVERSE SENSITIVITY
D. W. Rockwell and J. D. Ramboz *In* NRL The Shock and Vibration Bull. Feb. 1966 p 73–97 refs (See N66-28456 18-32) CFSTI: HC $6.00/MF $1.25

Accelerometer transverse sensitivity is reviewed in concept; commonly used measurement methods are discussed; and new measurement techniques are proposed. Several unique techniques of transverse sensitivity measurement are presented. These techniques do not depend upon the availability of pure unilateral motion, but employ methods of accounting for the vector components of the accelerometer output due to lateral motion. The proposed techniques have the advantage of not being limited to a single frequency. Preliminary tests have produced useful data at frequencies up to 2500 Hz. A special transducer has been fabricated with a low transverse sensitivity on a specified axis over a wide frequency range, i.e., less than 0.1 percent from 40 Hz to 1000 Hz, and less than 1 percent to 8000 Hz. The theories presented are not limited to piezoelectric accelerometers, but apply to other transducers which respond to composite vector stimuli. Author

N66-28470# Lockheed-California Co., Burbank.
A CONTINUOUS FREQUENCY CONSTANT Q SHOCK SPECTRUM ANALYZER
G. W. Painter and H. J. Parry *In* NRL The Shock and Vibration Bull. Feb. 1966 p 129–134 refs (See N66-28456 18-32) CFSTI: HC $6.00/MF $1.25

It was found necessary to develop a special analyzer for quick readout of the shock spectrum. The analyzer has several unique and interesting features which make it a valuable laboratory instrument whenever shock spectra must be determined. It may be used to analyze either complex transients or classical transients such as half sine or sawtooth pulses. In particular, the analyzer can maintain constant values of Q while the frequency is continuously variable from 0 to 2000 cps. In addition, it can be used to simulate force-excited or base-excited single-degree-of-freedom systems for broadband random or sinusoidal analyses. This paper describes the essential circuitry and design principles of the analyzer and presents typical performance data. Author

N66-28478# Boeing Co., Seattle, Wash.
TRANSIENT DATA DISTORTION COMPENSATION
John D. Favour *In* NRL The Shock and Vibration Bull. Feb. 1966 p 231–238 refs (See N66-28456 18-32) CFSTI: HC $8.00/MF $1.25

This paper discusses a technique capable of removing frequency dependent distortion from transient data. The instrumentation system transfer function is determined by dividing the Fourier integral transform of the output by the Fourier integral transform of a known input. The system inverse transfer function is then developed and applied to any output signal to remove distortion. Three test efforts were conducted to prove the feasibility of the technique. Distorted outputs with measurable errors in excess of sixty percent were reconstructed with errors of less than two percent. The mathematical method and limitations of the technique are defined. The design of a recommended calibration pulse generator is presented. Author

N66-28483*# Mechanical Technology, Inc., Latham, N. Y.
INVESTIGATION OF AN AXIAL-EXCURSION TRANSDUCER FOR SQUEEZE-FILM BEARINGS
F. K. Orcutt, C. Kissinger, and C. H. T. Pan Dec. 1965 42 p refs
(Contract NAS8-11678)
(NASA-CR-75696; MTI-65TR63) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The operation of an experimental axial-excursion squeeze-film gas bearing transducer apparatus is described; and a schematic diagram of the transducer design, and a photograph of the unit as tested are depicted. The design parameters and operating variables of the apparatus are given, along with curves showing the relationship among these parameters. Experiments were performed on the transducer-bearing assembly for observing its behavior and for improving its performance. The resonant frequencies of the transducer were surveyed; characteristic motions of the bearing cone were investigated; and the effects of drive voltage, preload, bearing mass, clamping ring mass, and of the centerplane mounting ring were determined. The overall results are encouraging with respect to further developing an axial-excursion transducer culminating in a prototype support for an actual gyro float. The various data are graphically depicted. L.S.

N66-28505# Joint Publications Research Service, Washington, D. C.
OPTICAL METHOD OF RECORDING INSTRUMENT READINGS IN FILMING SUSPENSION CURRENTS
V. I. Loginov *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 57–59 (See N66-28499 18-14) CFSTI: $3.00

Described is a motion picture survey of water suspension currents that was used to study velocity fields and turbidity without flow disruption. The velocity field was recorded by using oil mixtures or solids as indicators floating through an illuminated zone where they were photographed. Reflections of a timing device and fiducial marks from electrical signal lamps were recorded at the same time. G.G.

N66-28516# Naval Research Lab., Washington, D. C. Physical Chemistry Branch.
RAPID ANALYSIS WITH A GAS CHROMATOGRAPH-MASS SPECTROMETER COMBINATION
F. E. Saalfeld *In its* Rept. of NRL Progr. Apr. 1966 p 10–18 (See N66-28514 18-23) CFSTI: $1.25

A gas chromatograph–mass spectrometer combination has been installed that will analyze extremely complex mixtures in a relatively short period of time. This is accomplished by separating the mixture into single components which are then identified by their mass spectrum. By the use of this combination, mixtures whose extreme complexity prohibited analysis only a few years ago can now be analyzed in a routine manner. Author

N66-28635# California Univ., Berkeley. Lawrence Radiation Lab.

A METHOD OF MAKING THIN-WINDOW GERMANIUM DETECTORS

Fred S. Goulding and Blair V. Jarrett 17 Jan. 1966 9 p refs (Contract W-7405-ENG-48)
(UCRL-16480) CFSTI: HC $1.00/MF $0.50

A method is described for producing thin-window lithium-drifted germanium X- or γ-ray detectors. The success of the process is indicated by a high yield of good detectors. Measurements show that the window thickness is in the range of 1 micron or less and X-ray energy resolution figures of 1.4 keV (full width at half minimum) were obtained. Some initial tests using the detectors for long-range proton energy measurements show that the negligible window thicknesses combined with thick depletion layers (easily obtained with germanium) promise to extend the usefulness of semiconductor detectors in particle as well as X-ray experiments.
Author (NSA)

N66-28637# Naval Ordnance Lab., Corona, Calif. Research Dept.

PROPERTIES OF PHOTODETECTORS Photodetector Series, 69th Report

W. L. Eisenman 15 Feb. 1966 51 p refs
(NOLC-637; AD-631225) CFSTI: HC $3.00/MF $0.50

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N66-28638# Infrared Industries, Inc., Santa Barbara, Calif.

AGING OF PbS DETECTORS

John Bisbee *In* Naval Ordnance Lab. Properties of Photodetectors 15 Feb. 1966 p 4–11 ref (See N66-28367 16-14) CFSTI: HC $3.00/MF $0.50

Detectivity, signal and noise, time constant, resistivity, and other aging characteristics are discussed for lead sulfide detectors; and circuit design to remove aging effects is demonstrated. Observed variation of signal and noise with aging is minimized by proper selection of load resistance. No change of detectivity is produced, but the designed detector results in a slow resistance decrease with time. Matched pairs of detectors are also considered.
M.W.R.

N66-28639# Texas Instruments, Inc., Dallas.

AGING AND STORAGE CHARACTERISTICS OF INSB INFRARED DETECTORS MANUFACTURED BY TEXAS INSTRUMENTS

Bill Kolander *In* Naval Ordnance Lab. Properties of Photodetectors 15 Feb. 1966 p 12–16 (See N66-28367 16-14) CFSTI: $3.00/MF $0.50

Two types of glass dewar packages and photovoltaic and photoconductive In Sb detectors were subjected to stability testing. Nine randomly selected standard photovoltaic detectors were fabricated in miniature glass dewar and stored at elevated temperatures for 2000 hrs. No systematic changes in D* or impedance were noted and no failures occurred. The liquid nitrogen hold time of this type dewar decreased less than 20% during the 2000-hr storage period. Ten of the photoconductor detectors are undergoing a 5000-hr life test in a larger type dewar, with five stored at 25°C and the other five at 75°C. Changes in D*, impedance, and hold time are less than 20% at 25°C and have essentially stabilized during the 3500-hr storage period; percent change in these parameters for the 75°C storage (2500 hr) is somewhat higher and more accelerated in time than at 25°C.
M.W.R.

N66-28640# Santa Barbara Research Center, Goleta, Calif.

STORAGE AND AGING DATA ON PbSe INFRARED DETECTORS

K. S. Pilger *In* Naval Ordnance Lab. Properties of Photodetectors 15 Feb. 1966 p 17–35 (See N66-28367 16-14) CFSTI: HC $3.00/MF $0.50

Analysis has been made of storage and aging of PbSe infrared detectors. Three groups of detectors were analyzed at −196°C. Two of the groups were taken from the production line after having passed normal acceptance and environmental testing; one group contained 72 detectors of relatively low resistance, the other 20 relatively high-resistant detectors. The third group, consisting of 20 detectors with a special polycoating of the sensitive element, had resistances ranging from 70 to 210 kΩ. A 24-month test program showed that all detectors were acceptable for use at −196°C. They all exhibited a downward shift in average resistances, signal levels, and noise levels during the first six months, after which a leveling off occurred. The polycoated detectors did not exhibit as great a change as the uncoated ones. Six lots of 20 detectors each were packaged and stored in heat-sealed bags at 68 to 78°C for six months, half of which contained desiccant. No significant differences were found for the two groups. Dark resistance increased approximately 50% for all the detectors, and very normal aging trends were exhibited.
M.W.R.

N66-28641# Servo Corp. of America, Hicksville, N. Y.

SHELF LIFE CHARACTERISTICS OF THERMISTOR BOLOMETER INFRARED DETECTORS MANUFACTURED BY SERVO CORPORATION OF AMERICA

Arthur Woodward *In* Naval Ordnance Lab. Properties of Photodetectors 15 Feb. 1966 p 36–38 (See N66-28637 16-14) CFSTI: HC $3.00/MF $0.50

Eight types of thermistor bolometer infrared detectors were evaluated to determine their shelf life characteristics in an uncontrolled environment with a temperature range of between 68 and 85°F and a relative humidity between 20 and 50%. Two types of detectors were mounted on the rear surface of a germanium hemispherical lens; the others on copper heat sinks. An increase in noise ratio, defined as the ratio of detector noise output with bias to that without bias, did not increase the failure rate.
M.W.R.

N66-28642# Barnes Engineering Co., Stamford, Conn.

NUCLEAR RADIATION EFFECTS ON INFRARED DETECTORS AND OPTICAL MATERIALS

Russell DeWaar *In* Naval Ordnance Lab. Properties of Photodetectors 15 Feb. 1966 p 39–48 refs (See N66-28637 16-14) CFSTI: HC $3.00/MF $0.50

A summary is presented on data relating to the effects of nuclear radiation on infrared detectors and window materials. Thermistor bolometers, lead sulfide and lead selenide cells, and indium antimonide detectors were found to exhibit decrease in signal at neutron flux densities above 1×10^{13}, with a drastic decrease at 1×10^{14} neutrons per cm^2. In another study, indium antimonide detectors survived irradiation to 3.4×10^{7} roentgens of Co^{60} gamma rays without serious damage, whereas lead tellurium detectors were found to be unsuitable in a radiation environment. If tellurium detectors are allowed to spend some time at room temperature between irradiation and use, they are usable to 4×10^{7} with somewhat reduced performance. Data are given for other detectors and for optical materials which are involved in various space projects. It is pointed out that there are serious omissions in the available data, particularly with regard to the Van Allen radiation belt and on lead selenide and extrinsic doped germanium photodetectors. M.W.R.

N66-28649# Joint Publications Research Service, Washington, D. C.

NEW OPTICAL RHEOSTAT

I. I. Stas' *In its* Recent Develop. in Soviet Oceanog. 17 Feb. 1966 p 25–26 (See N66-28646 16-13) CFSTI: $2.00

An optical rheostat, to replace the slide rheostat, is described. It consists of an ohmic resistance, a ceramic base, and a photoresistor. It is considered that the optical rheostat can attain a greater accuracy in determining the angle of rotation of the sensing element of the pickup than can the slide rheostat. N.E.N.

N66-28650# Joint Publications Research Service, Washington, D. C.

USE OF THE ALEKSEYEV PRINTING CURRENT METER FOR STUDYING STORM CURRENTS IN COASTAL WATERS

A. I. Filimonov *In its* Recent Develop. in Soviet Oceanog. 17 Feb. 1966 p 27–32 (See N66-28646 16-13) CFSTI: $2.00

The use of printing current meters and their installation are discussed. Three types of suspension and their advantages are described. (1) The tripod permits reliable data to be taken on the direction and velocity of storm current when waves are up to class 7. (2) The prism frame can be put into position without using a diver, and should be used at depths greater than 6–7 meters. (3) The third method utilizes a 100–150 liter buoy on the surface of the sea, from which the current meter is suspended. Observational data for storm currents in the Baltic Sea showed the possibility of using the printing current meters for investigating the dynamics of coastal waters. N.E.N.

N66-28785*# Ampex Corp., Redwood City, Calif.

INCREMENTAL MAGNETIC TAPE DRIVE MECHANISM Final Report, 23 Aug. 1965–Mar. 1966

[1966] 97 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951289)

(NASA-CR-75788) CFSTI: HC $3.00/MF $0.75 CSCL 14C

This report concludes the work on the incremental magnetic tape drive mechanism. An engineering model of the incremental drive was designed, fabricated, and delivered fulfilling all those requirements set forth by the contractor. Author

N66-28786*# Illinois Univ., Urbana. Coordinated Science Lab.

THEORETICAL AND EXPERIMENTAL STUDIES OF THE UNDERLYING PROCESSES AND TECHNIQUES OF LOW PRESSURE MEASUREMENT Final Report

D. Alpert Apr. 1966 164 p refs

(Grant NsG-376; Contract DA-28-043-AMC-00073(E))

(NASA-CR-75681; R-286; AD-632596) CFSTI: HC $5.00/MF $1.00 CSCL 14B

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N66-28787*# Illinois Univ., Urbana. Coordinated Science Lab.

THE SUPPRESSOR (SCHUEMANN) GAUGE

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 1–20 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

A relatively simple ionization gauge called the photocurrent suppressor gauge for measuring down to 10^{-13} Torr was developed. The gauge is capable of effectively suppressing the photoelectric current (X-ray current) from the ion collector, thereby considerably extending the range of ionization-type gauges. Its cost in quantity would be little more than a standard inverted gauge while it can measure pressures hundreds of times lower. Because of the compatibility of existing ion gauge supplies, electrometers, and measurement techniques, the suppressor gauge is believed to offer the most promise for vacuum researchers to develop the know-how to reliably obtain pressures in the 10^{-11} and 10^{-12} Torr region. Results indicate that the ion source used in the suppressor gauge could be applied to other instruments, such as mass spectrometers or other types of gauges. R.N.A.

N66-28788*# Illinois Univ., Urbana. Coordinated Science Lab.

MODIFICATION OF THE BAYARD–ALPERT GAUGE BY THE ADDITION OF A SECOND COLLECTOR

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 21–25 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

A modified inverted ionization gauge is described in which the effective X-ray limit has been substantially reduced. The modification involves the addition of a second collector to the gauge which is biased at a potential below that of the first collector. With the second collector, the gauge may be operated in the Redhead mode, i.e., the second collector may be used to modulate ion current using an ac voltage. The modified gauge has an effective X-ray limit at least one, and possibly two, orders of magnitude below that of a standard inverted ionization gauge. Since the gauge is a simple modification of the original Bayard–Alpert design, it can operate with standard power supplies. The ultimate pressure measurable with the gauge is limited by the quality of the differential microammeter and by the experimenter's ability to eliminate stray dc leakage currents. Since quality differential microammeters are available commercially, this gauge is an attractive solution to the problem of reading pressures into the 10^{-12} Torr pressure region. R.N.A.

N66-28789*# Illinois Univ., Urbana. Coordinated Science Lab.

A SIMPLE HIGH-SENSITIVITY MASS SPECTROMETER

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 26–30 (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

An easily operated high sensitivity mass spectrometer which can be placed on any vacuum station and which uses a magnetic field was investigated theoretically and a model briefly tested. In a mass spectrometer using a magnetic field where a high sensitivity without an electron multiplier is desired, it is necessary to eliminate fine slits and small cylindrical electron beams. The mass spectrometer described is a partial solution to these problems in that a sheet beam of electrons is used and only one slit for ions is needed. Two forms of the instrument are possible. The more complicated one gives higher resolution while the less complicated simplifies the electron space charge neutralization problem. A complicated version was built and operated in a magnetic field supplied by a permanent magnet. It had a sensitivity of 10^{-2} amps/Torr and a resolution of about 10. The expected sensitivity was 30. Its low sensitivity was attributed to the slit passing only a fraction of the ions through to the collector due to poor ion focusing. The instrument offered little more in economy or performance over normal deflection-type mass spectrometers. Therefore, work on the instrument was discontinued. R.N.A.

N66-28790*# Illinois Univ., Urbana. Coordinated Science Lab.

EFFECTS OF ELECTRON-SURFACE INTERACTION IN IONIZATION GAUGES, INCLUDING O_2 TO CO CONVERSION

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 31–48 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

An anomalous behavior of ionization gauges, characterized by a departure from proportionality between the ion collector current and the electron current to the grid, was investigated. Experiments with the Redhead modulator and the Schuemann suppressor gauges are described, and data from the suppressor gauge experiment are graphed. The collection efficiency of a single collector Bayard–Alpert gauge as a function of collector voltage was studied for evidence relating to the surface impact ionization hypothesis. The collector efficiency was found to be correlated with the enhanced rate of ion production. Further support for the hypothesis was provided by the ions produced in a magnetic deflection mass spectrometer. A comparison of ionization gauge readings in the presence of oxygen and carbon dioxide was made. Among the conclusions are: (1) Evidence was obtained in support of the hypothesis of surface dissociative ionization by electron impact at the grid surface. (2) The presence of oxygen gives rise to erroneous gauge readings. (3) Thorough outgassing of the grid by electron bombardment reduces anomalous readings. N.E.N.

N66-28791*# Illinois Univ., Urbana. Coordinated Science Lab.

AN EVALUATION OF THIN FILM ELECTRON SOURCES FOR USE IN IONIZATION GAUGES

In its Theoret. and Exptl. Studies on the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 49–51 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

Thin film tri-layer devices were fabricated and evaluated as possible electron sources for mass spectrometers and ionization gauges. The devices consisted of an evaporated metal base, a thin insulating film, and a thin covering metal film. The sandwich materials were usually aluminum–aluminum oxide–gold, although tin oxide was also used. Electron emission currents up to several microamperes were observed, but gave a fractional-hour life. The electron current was noisy. Cold cathodes using cesium to lower the work function of the outer metal film, and a combination tri-metal cathode with a resistance strip electron multiplier are mentioned. N.E.N.

N66-28792*# Illinois Univ., Urbana. Coordinated Science Lab.

A HIGH RESOLUTION SECONDARY EMISSION SPECTROMETER FOR SURFACE RESEARCH

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 52–85 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

The possibility of using secondary emission in surface research and the apparatus developed for this research are discussed. The secondary electrons were divided into two groups: primary electrons scattered (elastically or inelastically) from the surface, and electrons excited from the surface by the primaries. It is suggested that the following main areas can be investigated using the elastically scattered electrons: (1) the excitation of the vibrational states of adsorbed gas specie on the surface; (2) the electronic transitions of the adsorbed atoms on surfaces; and (3) the plasmon excitation by electron impact. Details of the apparatus constructed for high resolution studies are given and schematic diagrams are included. The operation of the monochromator–analyzer system is described, and the operating characteristics are shown in graphed form. Measurements obtained on the (100) surface of a tungsten single crystal ribbon are discussed, and the energy distribution of secondary electrons from a contaminated surface, from the surface after exposure to nitrogen and hydrogen, and from clean tungsten are presented. N.E.N.

N66-28796*# Illinois Univ., Urbana. Coordinated Science Lab.

PUMPING SPEEDS OF GETTER-ION PUMPS AT LOW PRESSURES

In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 113–125 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

The pumping speed and discharge intensity measurements for a small getter ion pump, and the saturation effects for a diode and a triode type pump are discussed. Details on the apparatus are given. Pumping speeds at constant pressure

were recorded over a period of one day through the pressure range -10^{-11} to 10^{-6} Torr. Field emission currents were found to reach a few hundred microamperes in the triode pump, and a few microamperes in the diode when pumping nitrogen. The gases used were hydrogen, helium, and nitrogen. Graphs are presented for each gas for (1) the intensity vs pressure in the diode pump, (2) pumping speed and discharge intensity vs pressure in the diode pump, and (3) pumping speed vs pressure in the triode pump. It was found that the discharge intensity is proportional to pumping speed for pressures below 10^{-6} Torr for short pumping times. Saturation occurred after pumping times of the order of a day at pressures above 10^{-7} Torr. No significant difference in pumping speed or saturation time was noticed between diode and triode. N.E.N.

N66-28816# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

A COMPARISON OF A DOUBLE DIFFRACTING X-RAY UNIT WITH A STANDARD X-RAY DIFFRACTION UNIT

W. I. Clark *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 73–81 (See N66-28808 16-17)

A sample of unirradiated uranium with a random orientation was run on a standard X-ray diffraction unit, then in a double-diffraction unit. The relative intensity of the diffraction patterns for the 18 planes was calculated by setting the 021 plane equal to 100. The difference between the experimental values and the standard intensity values was determined, and this difference plotted as a function of the 2 θ values. The set of data from the standard unit had a random distribution, whereas the data points from the double-diffracting unit seemed to form an inverted parabola. A curve of the general form, $a+bx+cx^2-y=0$, was calculated using the least-squares method. The standard intensity ratios were modified to reflect the difference between the double diffracting and standard unit. This difference was caused by a slight misalignment of the single crystal. This curve would hold true only for those data run under these instrumental conditions. Author (NSA)

N66-28858# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

A NEW METHOD FOR ANALYSING RANDOM DATA [UNE NOUVELLE METHODE D'ANALYSE DES PHENOMENES ALEATOIRES]

Gabriel Coupry 1966 35 p refs Presented at the 4th Intern. Symp. on Aerospatial Instrumentation, Cranfield, England, 21–24 Mar. 1966

(TP-330) CFSTI: HC $2.00/MF $0.50

A description of new devices for analyzing random data is proposed, with emphasis on the measurement of spectral densities. For this purpose, a method is deduced from Rice's formula, using the measurement of the number of zero-crossings of the process. Though not the best of the methods that could be used for this sort of data reducing, it is probably the cheapest and the fastest, and fits fairly well with all the problems encountered on turbulence work. After a short survey of the theoretical background, and a description of the equipment used, it is explained how the whole method has been checked through a set of experiments on a cantiliver beam. Author

N66-28906# Weapons Research Establishment, Salisbury (Australia).

SKYSCREENS

J. Wood Mar. 1966 19 p

(WRE-TN-ISD-66) CFSTI: HC $1.00/MF $0.50

Skyscreens may be used to monitor trajectory for safety purposes, during the first few thousand feet of flight of missiles with low initial acceleration. Skyscreen curves are calculated to allow for horizontal movement between cutdown and impact. The theory is given, together with sample computations using a Fortran program. Author

N66-28915# Atomic Weapons Research Establishment, Aldermaston (England).

A CALIBRATION SYSTEM FOR PIEZO-ELECTRIC ACCELEROMETERS

D. P. Welham and R. Allison Feb. 1966 25 p refs

(AWRE-O-100/65) HMSO: 3s 3d

An easily used calibration system for piezo-electric accelerometers is described. The system uses a moiré fringe method of amplitude measurement. Voltage measurements are made by the substitution of an ac voltage whose RMS value is compared with a very stable dc voltage which can be referred to a Weston standard cell. A test of the system's stability at 180.6 c/s and ±10 g produced a pooled standard deviation of 0.36% on the value of the charge sensitivities of nine accelerometers which were each calibrated ten times over a period of 8 days. When this test was repeated with the accelerometers at a constant temperature of +25°C an improvement in the standard deviations was observed. A calibration accuracy of ±2% is estimated. Similar results are expected over the range 60–600 c/s at acceleration levels of ±1 to ±20 g within amplitude and thrust limits of 0.015 in. and ±20 g respectively. Author

N66-29000# Central Lab. for Radiological Protection, Warsaw (Poland).

RADIATION DOSE SENSITIVE POCKET ALARM MONITOR [KIESZONKOWY SYGNALIZATOR PRZEKROCZENIA DAWKI PROMIENIOWANIA GAMMA]

B. Bukowiecki 1965 8 p refs In POLISH; ENGLISH summary (CLOR-43/D)

An instrument that gives an acoustic alarm when a dose of 300 mR is accumulated is described. NSA

N66-29031# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.

STRAIN GAGE TECHNIQUES AND ASSOCIATED TESTS ON PRESSURE VESSELS AND MATERIALS

P. J. Long 15 Mar. 1966 29 p refs Presented at the Symp. on Nondestructive Testing, Los Alamos, N. Mex., 3–5 Nov. 1965

(Contract W-7405-ENG-26)

(Y-KD-5; CONF-651141-1) CFSTI: HC $2.00/MF $0.50

The use of strain gages to determine the stress distributions over pressure-vessel surfaces, to evaluate welded repairs on high-carbon-steel material in a gas storage vessel, and to determine the dynamic properties of materials that are subjected to high strain rates is discussed. Techniques for the application of strain gages to threaded regions are described. NSA

N66-29034# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

AN AREA GAMMA MONITOR WITH AUTOMATIC RANGE CHANGING

A. R. Jones Dec. 1965 14 p
(AECL-2533) Available from Atomic Energy of Canada, Ltd., Chalk River: $0.50

An area gamma monitor is described which is intended for the measurement of exposure rates in the range 0.2 milli-Roentgens/hour to 10 Roentgens/hour. The output is displayed on two quasi-logarithmic ranges and automatic range changing is provided to switch the monitor to the less sensitive scale whenever a selected exposure rate is exceeded. The monitor has a rapid response. The detector unit, containing two Geiger tubes, may be separated from the main unit by at least 300 feet of cable. A detailed circuit description and a settling-up procedure are contained.
Author (NSA)

N66-29051# Los Alamos Scientific Lab., N. Mex.
AN INVESTIGATION OF NEUTRON COLLIMATORS AND THEIR APPLICATION IN NEUTRON RADIOGRAPHY
Roger A. Morris (M.S. Thesis, New Mexico Univ.) 1965 81 p refs
(Contract W-7405-ENG-36)
(LA-DC-7594) CFSTI: HC $3.00/MF $0.75

A preliminary experimental and theoretical description of a Soller-type collimator for use in neutron radiography is presented. A review of the more important procedures and types of equipment used in neutron radiography is given, followed by a theoretical description of a Soller collimator. A series of experiments that were performed to verify the theoretical predictions is summarized.
NSA

N66-29059# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
FAST RESPONSE MICRO-MICROAMMETER
M. Hendricks 1 Nov. 1965 16 p
(Contract AT(29-1)-1183)
(EGG-1183-1165) CFSTI: HC $1.00/MF $0.50

An amplifier capable of observing currents in the microampere to picoampere range with certain advantages over amplifiers used in the past is described in terms of its design and performance.
NSA

N66-29075*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF AN AUTOMATIC AEROSOL PARTICLE COUNTER FOR MEASURING THE AIRBORNE CONTAMINATION LEVEL IN A CONTROLLED ENVIRONMENT
Theodore W. Lewis 24 Mar. 1966 39 p refs
(NASA-TM-X-53416) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The automatic aerosol particle counter and the microscopic particle counts were in satisfactory agreement. However, the automatic counter is more efficient in counting particles at 0.6 micron or 0.75 micron as compared to the microscopist, who is restricted to counting particles 5 microns or larger. A method of correlating the sizes and quantities of particulate contamination present at any time is submitted for consideration. By using the particle size distribution curve, based on Stokes' Law, the number of particles for each different size may be estimated. Acceptance of this method will make it possible to use the automatic counters in a continuous monitoring program. This will provide a prompt recording of the contamination level in the environment monitored. Author

N66-29078*# Electro-Optical Systems, Inc., Pasadena, Calif.
SOLAR REFLECTING BEACON Final Report, 16 Jun. 1965-16 Apr. 1966
D. E. Stewart, B. E. Kalensher, and G. A. Jelley 16 Jun. 1966 176 p refs
(Contract NAS9-4790)
(NASA-CR-65403; EOS-6976-Final) CFSTI: HC $5.00/MF $1.00 CSCL 17H

Conceptual and engineering designs were developed for two types of lunar solar reflecting beacons to be emplaced during the early Apollo lunar landing missions. One beacon is to be visible from the earth; and the other is to be visible from both the Apollo command module and the lunar excursion module vehicles. The earth viewed beacon weighs 20 pounds and has a one cubic foot volume design specification. The cislunar beacon, visible to the astronauts during the descent of the lunar excursion module, is viewed over a 20° by 39° field, and has a weight of five pounds and 0.25 cubic foot volume design specification. Both beacons have a one year operating life and 0.90 reliability. The earth beacons will be detectable both visually and photographically; the cislunar beacons, only visually.
D.T.

N66-29086# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
COORDINATE METER R.M.C.-II [IL MISURATORE DI COORDINATE R.M.C.-II]
M. De Giorgi, G. Schiavon, and F. Soso 14 Dec. 1965 20 p ref In ITALIAN *Its* Nota Interna No. 295
(LNF-65/43)

A semi-automatic system that was developed for the scanning of photographs of oscillographic traces is described.
NSA

N66-29096# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
A SPECTROMETER FOR 14 MEV NEUTRON CAPTURE SPECTROSCOPY
F. Cvelbar, A. Hudoklin, M. V. Mihailovic, M. Najzer, and V. Ramsak Nov. 1965 15 p refs Submitted for Publication
(NIJS-R-470)

A telescopic scintillation pair spectrometer for the measurements of gamma ray spectra from the radiative capture of 14-MeV neutrons is described. The main parts of the spectrometer are: a lead foil as a converter of gamma rays to electron–positron pairs, a 12.5 cm dia ×12.5 cm long plastic scintillator in which the energy of pairs is absorbed, and an arrangement of two thin plastic scintillators. Two thin scintillators together with the appropriate electronics present a coincidence–anticoincidence shield which appreciably reduces the background from charged particles created in the main scintillator or coming into the spectrometer from outside. The meson background in the whole energy range of the spectrometer is reduced to about 0.5 cpm. The energy resolution of the spectrometer is 15.2, 9.5, and 8.0% for gamma rays of 12.1, 16.5, and 20.4 MeV respectively. An average value of the spectrometer efficiency in this energy region is 0.5%. The gamma ray spectrum from the capture of 14 MeV neutrons in Fe^{56} is shown as an example of the application of the spectrometer.
Author (NSA)

N66-29107# California Inst. of Tech., Pasadena. Synchrotron Lab.
A LARGE SPARK CHAMBER FIELD-LENS

Jerome Pine 15 Jan. 1965 10 p *Its* Internal Rept.-14
(Contract AT(11-1)-68)
(CALT-68-30) CFSTI: HC $1.00/MF $0.50

A field lens for viewing a large spark chamber with a 3/8" gap was designed. The lens will be made out of lucite sheet and mineral oil. The main features and the performance of the first model are discussed. NSA

N66-29110# California Univ., Berkeley. Lawrence Radiation Lab.
AN IMPROVED ^{3}He NEUTRON SPECTROMETER
William Alois Bair (M.S. Thesis) 21 Jan. 1966 141 p refs
(Contract W-7405-ENG-48)
(UCRL-16595) CFSTI: HC $4.00/MF $1.00

Preliminary results of a ^{3}He neutron spectrometer being developed at the Lawrence Radiation Laboratory are presented. The spectrometer will be capable of presenting neutron spectra to an upper limit of 14.0 MeV. The spectrometer employs a ^{3}He–Kr gas mixture in a proportional counter, and the reactions ^{3}He(n,p)T and ^{3}He(n,d)D are utilized to obtain the incident neutron energies. Recoils from ^{3}He, Kr, and the stabilizing gas (CO_2) are electronically removed from the spectra by taking advantage of the shorter rise times of the recoil pulses. An analytic analysis of the rise time discrimination pulse rejection, the wall effects, and the spectrometer efficiency is presented. A computer program and an inversion matrix are developed (based on the analytic analysis presented) by means of a random probability analysis. The inversion matrix should permit the correction of a raw neutron spectrum output from a multichannel analyzer to a final neutron spectrum by correcting in a single operation for: (a) rise time discrimination, (b) wall effects, and (c) spectrometer efficiency. Appendices include a table of comparative physical and operational characteristics of all ^{3}He proportional counters and ionization chambers constructed, and reported in the technical literature to date. The complete electronic circuitry necessary to construct the rise time discriminator units, and the computer program CATMAN developed for the random probability analysis are also presented as separate appendices. Author (NSA)

N66-29119# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A BINARY-CODED DIGITIZED HODOSCOPE
E. F. Beall Nov. 1965 12 p refs *Its* Tech. Rept.-514
(Contract AT(40-1)-2504)
(TID-22553) CFSTI: HC $1.00/MF $0.50

A binary hodoscope was constructed. The design of this hodoscope is described, and the results of tests show that of the light injected into one end of a strip, typically 35% reaches each PM photocathode to which the strip is optically coupled. The pulse height from a wrong tube, that is, one which is not optically coupled to the strip under test, is typically 5% of the pulse height from a right tube. Based on the data it is estimated that a minimum-ionizing particle which traverses a strip along the 3/8-in. direction should cause on the order of 500 photons to impinge upon each photocathode to which the strip is optically connected. This would be more than adequate to make the device function. NSA

N66-29205# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MEASUREMENT OF HEAT TRANSFER AT NOZZLE THROAT BY IMBEDDED PYROMETER METHOD
S. A. Elder and F. K. Hill Jan. 1964 18 p refs
(Contract NOw-62-0604-c)
(TG-552; AD-631621) CFSTI: HC $1.00/MF $0.50

A newly developed transistorized radiation pyrometer was employed in temperature and heat transfer studies of the nozzle of a rocket exhaust powered Mach 5 hypersonic wind tunnel. The investigation also involved boundary layer measurements and spectroscopic determination of gas species concentration. Author (TAB)

N66-29224*# Phylatron Corp., Columbus, Ohio.
SOLID STATE CRYOGENIC TEMPERATURE SENSOR Final Report
W. H. Closser and R. R. Speers 1 Feb. 1966 31 p refs
(Contract NAS3-6219)
(NASA-CR-54962) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The various phases of the device development phase are discussed in detail. These include: the selection of the starting material and its pertinent electrical properties; wafer preparation; diffusion techniques and studies including preparation; diffusion techniques and a theoretical analysis which led to the selection of an elemental Zn diffusion source; contacting; mesa formation, and bonding. The ceramic package initially intended for use with these devices is discussed along with the experimental difficulties encountered in sealing the package; and the experimental results leading to the selection of the TO-46 package are presented. A description of the calibration system used for device testing is presented. The various calibrations and tests including shock and reproducibility tests, calibration and calibration at various current levels, and life tests are discussed; the results are presented. The junction evaluation studies which include I-V characteristics and junction capacity measurements are discussed. A GaAs temperature sensor possessing many of the properties of an ideal resistance thermometer has been developed. Author

N66-29328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DOUBLE FOCUSING MAGNETIC MASS SPECTROMETER FOR SATELLITE USE
Carl A. Reber and Lawrence G. Hall (Consolidated Systems Corp.) [1965] 39 p refs Submitted for Publication
(NASA-TM-X-58446) CFSTI: HC $2.00/MF $0.50 CSCL 20F

The requirements, configuration, and characteristics of the mass spectrometer system used in the Explorer XVII satellite are described. The double focusing (angle and energy) magnetic instrument ionizes neutral species, collects the ions of He^+, N^+, O^+, H_2O^+, N_2^+ and O_2^+ in fixed position collectors, and commutates resulting currents into a logarithmic detector system. Sequential measurements of the six ion currents over a compressed seven decade dynamic range are provided. The open ion source extends from the satellite surface to allow entry of the 0.4 to 12 ev neutral particles from 2π steradians solid angle. Sensitivity for m/e 28 of N_2 is typically 10^{-4} amperes/torr when the ion source potentials are adjusted for acceptance of energetic particles. Flat-topped peaks are used to minimize error due to possible drift in the high voltage power supplies. A 360°C bakeout and ceramic-sealed caps, which permit launching in vacuum and are ejected in flight, reduce the background due to outgassing. Author

N66-29331*# Bendix Corp., Davenport, Iowa. Pioneer-Central Div.
DEVELOPMENT OF A PROTOTYPE LH_2 CAPACITANCE TYPE MASS FLOWMETER AND READOUT Summary Report

Thomas A. Loftus 22 Feb. 1965 63 p *Its* Publ. No. 3170-65 (Contract NAS8-5218)
(NASA-CR-63521) CFSTI: HC $3.00/MF $0.75 CSCL 09C

Design details are given on a capacitive mass flowmeter with an electronic readout, built for use with liquid hydrogen. Preliminary LH_2 flow tests up to 2 lb/sec indicated that the force range of the flow sensor was adequate, that force nulling of screen drag forces was being accomplished by the electronic readout, and that the system was repeatable. Although the good correlation of the indicated mass rate of flow test data indicated that the basic theory of operation of the flowmeter system is sound, it was found that several problems exist in the present design. These problems include: excessive cool down time and temperature error, renulling at each cool down, oversensitivity to slight null errors, and overvulnerability to foreign materials in the fluid. It was concluded that modification of the force transducer to achieve a softer mechanical null is necessary to obtain a mass rate of flow accuracy ±1% of full scale from the capacitance type mass flowmeter system. L.E.W.

N66-29355*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF ABLATION SENSORS FOR ADVANCED REENTRY VEHICLES
Peter J. Le Bel and James A. Russell, III [1965] 5 p Presented at the Instr. Soc. of Am. 20th Ann. Conf. and Exhibit, Los Angeles, 4–7 Oct. 1965
(NASA-TM-X-56771) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The development of three sensors to measure the ablation parameters of advanced heat-shield materials during reentry is discussed. This paper will describe the design and mode of operation of the make wire, light pipe, and spring wire sensors and the results of the development program undertaken to qualify them for flight. The make wire sensor is designed to measure rate of recession of the char layer interface in a charring ablator, while the light pipe and spring wire sensors are designed to measure material surface recession rates. These sensors have been extensively tested in arc-jet facilities to evaluate their performance in a simulated reentry heating environment. Author

N66-29359*# Stanford Univ., Calif. Instrumentation Research Lab.
THE USE OF A LOGARITHMIC AMPLIFIER IN DATA PROCESSING OF ANALOG SIGNALS
Walter E. Reynolds 1 Apr. 1965 27 p refs
(Grant NsG-81-60)
(NASA-CR-62945; IRL-1017) CFSTI: HC $2.00/MF $0.50 CSCL 06B

A number of aspects of usage of a logarithmic amplifier for data compression and low level resolution are presented. These include an example of data interpretation and a derivation of error figures. An appendix contains a circuit and specifications of the logarithmic amplifier used. Author

N66-29360*# Melpar, Inc., Falls Church, Va.
RESEARCH AND DEVELOPMENT OF AN INSTRUMENT FOR DETECTION OF EXTRATERRESTRIAL LIFE BY OPTICAL ROTATORY DISPERSION Fourth Quarterly Report, 25 Nov. 1964–24 Feb. 1965
S. S. West [1965] 46 p refs
(Contract NASw-842)
(NASA-CR-57324) CFSTI: HC $2.00/MF $0.50 CSCL 06B

Progress is reported on the development of an instrument for detecting extraterrestrial life by means of optical rotatory dispersion. During this period debugging of the optical electronic breadboard was completed. Design of the mechanical and processing portions of the breadboard was initiated. Functional analysis and design of the complete system for automatic operation was initiated and is near completion. The spectral bandwidth of the radiation used to illuminate the sample was investigated. In terms of the nucleic acids, requirements are severe at 254 microns, but are considerably relaxed at 365 microns. Operation at 365 microns entails little or no loss in sensitivity and eases or eliminates many of the instrumentation problems. A study was begun to determine optimum conditions for extracting optically active products from soil samples. One technique uses radioactive tracers to determine extraction efficiency, but thus far, has only been applied to nucleic acids. Efficiencies attained to date are not optimum and work is continuing to improve the extraction process. R.N.A.

N66-29387*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPANSION OF THE EV SYSTEM
W. F. Lindsey [1965] 9 p refs Presented at the 10th Ann. Tech. Symp. of the Soc. of Photo-Opt. Instr. Engr., San Francisco, 16–20 Aug. 1965
(NASA-TM-X-56633) CFSTI: HC $1.00/MF $0.50 CSCL 14E

The exposure value system or additive value system has been expanded to include filter factors and transmittance. In addition, the equations for photoflash and electronic flash photography are converted into a form compatible with the EV system. The photographic factors are presented in tabular form together with their corresponding values in the additive value system in 25% steps or quarter stops to permit an acceptable solution to be obtained more readily. Author

N66-29412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME FABRICATION TECHNIQUES OF SPECTRAL LAMPS AND GAS ABSORPTION CELLS FOR RUBIDIUM MAGNETOMETERS
Homer L. Hoyt Jun. 1965 20 p refs Presented at the 10th Ann. Symp. and Exhibition of the Am. Sci. Glassblowers Soc. Submitted for Publication
(NASA-TM-X-56709; X-612-65-235) CFSTI: HC $1.00/MF $0.50 CSCL 20F

Although still a relatively new scientific instrument, the rubidium vapor magnetometer has rapidly become an important tool in the measurement of magnetic fields in many different applications. Experimental development of the spectral lamps and resonant absorption cells, which comprise the heart of the magnetometer, is being conducted at the Goddard Space Flight Center with the intent of optimizing these components. The early phases of this work have been directed toward perfection of fabrication techniques. This has led to: (1) a technique for manipulation of the rubidium metal such that it is available in stored quantities in the pure metal form, (2) methods of controlling the cleanliness in the filling operation and the amount of metal per cell, (3) the design of a liquid N_2 cold trap for a bakeable system, and (4) novel fixtures for fabricating glass components. The initial components fabricated by these techniques are currently being evaluated for performance and long life reliability. Author

N66-29429*# National Aeronautics and Space Administration. Washington, D. C.
A NEW HIGHLY LUMINOUS MASS SPECTROMETER FOR MEASURING THE COMPOSITION OF THE UPPER ATMOSPHERE [EIN NEUES LICHTSTARKES MASSENSPEKTROMETER ZUR MESSUNG DER ZUSAMMENSETZUNG DER HOHEN ATMOSPHARE] Technical Note No. T 8/61
J. Geerk Apr. 1964 16 p Transl. into ENGLISH from a publ. of the Deutsch-Franzosisches Forschungsinstitut, Saint-Louis (France), 29 Jun. 1962
(NASA-TT-F-8857) CFSTI: HC $1.00/MF $0.50 CSCL 20F

This paper describes the ion optics, dispersion, opening error, energy blurring error, total error, aplanatic image, ion source, and mass spectrogram of a new highly luminous mass spectrometer designed for measuring the composition of the upper atmosphere. A brief description, a photograph, and a function diagram of the first prototype, designed for flight with the Veronique, are given. A second launchable prototype which can be completely baked is also described. Author

N66-29434*# Arizona Univ., Tucson. Dept. of Physics.
A COMMERCIAL SPECTROMETER MODIFIED FOR X-RAY SPECTROSCOPY OF THE LIGHT ELEMENTS
Ralph W. G. Wyckoff and Franklin D. Davidson [1964] 9 p refs (Grant NsG-120)
(NASA-CR-60405) CFSTI: HC $1.00/MF $0.50 CSCL 20F

A description is given of the simple modifications required to adapt a vacuum X-ray spectrometer for light element analysis. Data are given showing its spectral efficiency for wavelengths through the Kα line of boron (λ=67Å). Author

N66-29450*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPANSION OF THE EV SYSTEMS
W. F. Lindsey [1965] 7 p refs Presented at the 10th Ann. Tech. Symp. of the Soc. of Photo-Opt. Instr. Engr., San Francisco, 16–20 Aug. 1965
(NASA-TM-X-56765) CFSTI: HC $1.00/MF $0.50 CSCL 14E

The exposure value (EV) system, or additive value system, has been expanded to include filter factors and transmittance. In addition, the equations for photoflash and electronic flash photography are converted into a form compatible with the EV system. The photographic factors are presented in tabular form together with their corresponding values in the additive value system in 25 percent steps or quarter stops to permit an acceptable solution to be more readily obtained. Author

N66-29463*# Fairchild Camera and Instrument Corp., Syosset, N. Y.
SCIENTIFIC OBJECTIVES, CAPABILITIES AND CALIBRATION REQUIREMENTS OF THE SURVEYOR S/C TV CAMERA SYSTEM Final Engineering Report
30 Apr. 1965 59 p refs
(Contracts NAS7-100; JPL-950665)
(NASA-CR-75885; SME-BA-145) CFSTI: HC $3.00/MF $0.50 CSCL 17B

An overall perspective on generic uses for the Surveyor Lander television system is presented, as background data for establishing performance requirements for the spacecraft and its associated TV camera system. Objectives are identified as the need for obtaining observations and information on lunar surface brightness and color for constructing models of possible lunar landing sites. Qualitative data on photogrammetric, photometric, and colorimetric criteria and capabilities are reported. Types of cartographic and topographic data to be supplied by descent observations and surface surveys are outlined. Calibration, alignment, positioning procedures, and specifications are also summarized for the TV equipment. S.P.

N66-29479*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATUS REPORT ON PHYSICS BRANCH LOW CURRENT DETECTOR PROGRAM
H. Z. Reed Oct. 1965 38 p
(NASA-TM-X-55496; X-623-65-391) CFSTI: HC $2.00/MF $0.50 CSCL 09C

In an attempt to improve the methods and hardware used to detect currents in the range 10^{-8} to 10^{-18} ampere, a literature survey was conducted to determine which components needed improvement. This report discusses these components and their problem areas. They include high megohm resistors, electrometer tubes, flight quality vibrating capacitor modulators, solid state devices, electron multipliers, insulators, and high impedance switching devices. R.N.A.

N66-29530# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Strahlenschutz.
A COMPARISON BETWEEN EXISTING METHODS OF MEASURING RADIOACTIVE PROBES BY CONSIDERING THEIR SENSITIVITY AND TIME OF MEASURING [EIN VERGLEICH ZWISCHEN EXISTIERENDEN METHODEN ZUR MESSUNG RADIOAKTIVER PROBEN BEI BERUECKSICHTIGUNG DER EMPFINDLICHKEIT UND DER GESAMTMESSZEIT]
Christo Kambourov Nov. 1965 21 p refs In GERMAN Submitted for Publication Supported in part by the Intern. Atomic Energy Agency
(SGAE-SS-3/1966) CFSTI: HC $1.00/MF $0.50

The present work compares existing methods for measuring radioactive materials. Compared are statistical accuracy and total time of measurement. The derived formula for the computation of the lowest-possible limit of indication permits sensitivity determination in all cases. Transl. by K.W.

N66-29564# Texas Univ., Austin. Defense Research Lab.
OPERATION AND MAINTENANCE MANUAL FOR THE SOLION UNIVERSAL SEISMOMETER
Robert S. Adair May 1966 70 p
(CGS-1198-66-1)

The operation and maintenance of the portable solion seismometer and operational amplifier are described in detail. The seismometer components are listed and illustrated. Specifications are given for operation characteristics, range of parameters, electrical requirements and physical characteristics. Installation, including equipment, connections, and placement, operation and adjustments of the solion seismometer, and calibration are reviewed. Maintenance techniques are listed for solion replacement and conversion procedures for vertical to horizontal, and horizontal to vertical operating positions. A troubleshooting chart is included, which lists problems and causes of solion, seismometer, amplifier, and thermal difficulties. Numerous tables and illustrations demonstrate techniques, components, assembly, and maintenance. L.E.W.

N66-29588# Naval Research Lab., Washington, D. C. Structures Branch.
LIMITATIONS OF INSTRUMENTATION FOR MECHANICAL SHOCK MEASUREMENT Interim Report

M. W. Oleson 1 Dec. 1965 29 p refs
(NRL-6342; AD-626571) CFSTI: HC $2.00/MF $0.50

The report is basically a review of contemporary mechanical shock measurement practice, the applicable instruments, and their range of use. It includes discussion of the problem factors which condition selection of a measurement system, most of the commonly employed transducers, a representative shock measurement application, and elementary accuracy considerations. A recent program carried out involving 1500 shock records provides useful examples of shock measurement applications of a variety of transducers. No specific conclusions or recommendations are presented in the report, since the purpose is to outline the capabilities and limitations of instrumentation suited for use in a variety of measurement problems. Author (TAB)

N66-29657*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DIM LIGHT PHOTOGRAPHY
Lawrence Dunkelman (NASA. Goddard Space Center) and Robert D. Mercer *In its* Gemini Midprogram Conf. Including Exptl. Results 1966 p 325–328 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A progress report on dim light photographic phenomena as recorded during Gemini VI-A and Gemini VII missions, is presented. Photographs taken and identified include: (1) black-and-white as well as color shots of the twilight scene; (2) a series showing night cloud cover where the illumination was the sum of lunar, airglow, zodiacal, and stellar light; (3) lightning; (4) airglow, edge-on; (5) thrusters; (6) Gemini VII spacecraft as photographed from Gemini VI-A; and (7) the third stage of a minuteman rocket and possibly its reentry vehicle. Reproductions of three photographs, whose analysis has recently begun, are shown together with a crew inflight checklist for the dim-light study. G.G.

N66-29659*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENT S-5, SYNOPTIC TERRAIN PHOTOGRAPHY
Paul D. Lowman, Jr. *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 347–351 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The S-5 Synoptic Terrain Photography experiment was successfully conducted during the Gemini VI-A and VII missions. The purpose of this report is to summarize briefly the methods and results of the experiment. Interpretation of the large number of pictures obtained will, of course, require considerable time, and a full report is not possible now. As in previous reports, representative pictures from the missions will be presented and described. Author

N66-29660*# Environmental Science Services Administration, Boulder, Colo.
EXPERIMENT S-6, SYNOPTIC WEATHER PHOTOGRAPHY
Kenneth M. Nagler and Stanley D. Soules *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 353–357 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The weather photography experiment conducted in the Gemini IV, V, VI-A, and VII missions resulted in a total of nearly 500 high-resolution color photographs showing clouds. Many of these illustrate interesting meteorological features on a scale between that obtainable from surface or aircraft views, and that obtainable from operational weather satellites. Author

N66-29661*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXPERIMENTS MSC-2 AND MSC-3, PROTON/ELECTRON SPECTROMETER AND TRI-AXIS MAGNETOMETER
James R. Marbach and William D. Womack *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 359–363 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

These experiments were the first of a continuing series of measurements of particles and fields to verify the shielding and predict the dosage for all manned spacecraft. The simultaneous measurement of the external radiation environment and the radiation dose received by the flight crew throughout a space mission serves to evaluate and perfect calculational techniques, whereby the dose to be received by the crew on any given mission can be estimated prior to that mission. Author

N66-29662*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXPERIMENT D4/D7, CELESTIAL RADIOMETRY AND SPACE-OBJECT RADIOMETRY
Burden Brentnall *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 365–377 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Details are given on the equipment used on Gemini V and VII to obtain accurate measurements of emitted and reflected radiance, and to determine the threshold sensitivity values in absolute numbers. The separation and correlation of specific targets with various backgrounds was another experimental objective. Two interferometer spectrometers and a multichannel spectroradiometer were used as sensing instruments, with the selection based upon the spectral bands to be investigated in each flight. The equipment is reviewed by component, and then integrally as an experimental system aboard the spacecrafts. Instrument parameters are listed, and schematics are included. Mission plans for each flight are given, along with a list of the measurements made. Preliminary results of the data reduction are discussed, and figures depict radiometer data from moon measurements (4000 Å), moon irradiance during alignment optimization (3000 Å), interferometer spectrometer data (1.88), and the values at several lunar irradiance measurements. M.G.J.

N66-29702# ARO, Inc., Arnold Air Force Station, Tenn.
CALIBRATION OF THREE VENTURI AIRFLOW METERING SYSTEMS WITH STING-MOUNTED CENTERBODIES AT CRITICAL AND SUBCRITICAL FLOW CONDITIONS
H. E. Wolff Arnold Eng. Develop. Center, May 1966 32 p refs (Contract AF 40(600)-1200)
(AEDC-TR-66-52; AD-632085) CFSTI: HC $2.00/MF $0.50

An experimental investigation was conducted to determine the discharge coefficient of a venturi airflow meter with various diameter centerbodies installed. A critical flow venturi for which a theoretical discharge coefficient had been experimentally verified was used as the calibration standard. The discharge coefficients for the test venturi without centerbody and with centerbodies of two different diameters were determined over a range of venturi throat Reynolds numbers from 0.32 to 3.20×10^6 at a constant inlet air total temperature of 70°F. The experimentally determined coefficients were in good

agreement with the theoretical value for all configurations tested. Maximum deviation (0.3 percent) of discharge coefficient from the theoretical value occurred with the venturi without centerbody operating at critical flow conditions.
Author (TAB)

N66-29725*# National Aeronautics and Space Administration, Washington, D. C.
MEASUREMENT OF THE MECHANICAL AND DYNAMIC CHARACTERISTICS OF RUBBER . [IZMERENIYE MEKHANICHESKIKH DINAMICHESKIKH KHARAKTERISTIK REZIN]
V. P. Volodin and Ye. V. Kuvshinskiy May 1966 16 p Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (Moscow), no. 2, 1957 p 94–97
(NASA-TT-F-10161) CFSTI: HC $1.00/MF $0.50 CSCL 14B
This article describes an apparatus for determining the dynamic modulus of elasticity and the angle of mechanical losses of rubber in the 20–300 cps frequency range and the −20 to +150° C temperature range under deformation conditions of uniaxial contraction–extension. Three independent methods are employed.
Author

N66-29780# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETECTION OF FISSION FRAGMENTS BY SECONDARY EMISSION [DETECTION DES FRAGMENTS DE FISSION PAR EMISSION SECONDAIRE]
Arlette Audias Oct. 1965 140 p refs In FRENCH
(CEA-R-2862)
A fission fragment detecting apparatus based on the principle that fragments tranversing a thin foil will cause emission of secondary electrons was investigated. The electrons are then accelerated (10 keV) and directly detected by means of a plastic scintillator and associated photomultiplier. The theoretical aspects and construction details of the apparatus are included.
NSA

N66-29811# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
RECENT ADVANCES IN THE DEVELOPMENT OF A MAGNETIC SUSPENSION AND BALANCE SYSTEM FOR WIND TUNNELS, PART III Annual Summary Report, Sep. 1963–Sep. 1964
Alan B. Copeland, Eugene E. Covert, and Timothy Stephens Wright-Patterson AFB, Ohio, ARL, Jun. 1965 52 p refs *Its* Tech. Rept.-98
(Contract AF 33(615)-1470)
(ARL-65-114; AD-619174) CFSTI: HC $3.00/MF $0.75
This report presents a discussion of the recent development work on a magnetic model suspension and balance system. System equipment additions and modifications are described. Wind tunnel test data, are presented. A summary of work done on dynamic stability testing with the magnetic balance is given. Studies on roll control, a digital position measuring system, and magnetic model configuration are discussed. A summary of the design of a magnetic suspension and balance system for a twenty-inch hypersonic tunnel is included.
Author

N66-29882# Naval Avionics Facility, Indianapolis, Ind.
CONDITION NECESSARY FOR A LINEAR RELATIONSHIP BETWEEN ION CURRENT AND DEPOSITION RATE
John G. Bennett 4 May 1965 17 p refs
(NAFI-TR-554; AD-632078) CFSTI: HC $1.00/MF $0.50
A mathematical study of the ionization rate monitor is made to establish the relationship between the ion current in the rate sensor and the rate of deposition of film upon a substrate. This relationship is necessary for designing a thickness monitor which indicates the time integral of deposition rate. If the deposition rate were proportional to the ion current, then the ion current could be directly integrated electronically to indicate the thickness of the deposited film; but if the deposition rate were a non-linear function of the ion current, then the ion current would have to be fed into a circuit that would perform certain operations upon the ion current that would give an output, proportional to deposition rate, which could then be integrated electronically. The mathematical condition necessary for the ion current in the evaporation rate monitor to be proportional to the deposition rate is found and shown to be satisfied. The limitations of this analysis are discussed.
Author (TAB)

N66-29897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING STRESSES IN METALS BY THE EDDY-CURRENT METHOD
M. M. Shel' 29 Apr. 1966 12 p refs Transl. into ENGLISH from Khim. i Neft. Mashinostr. (Moscow), no. 4, 1964 p 35–37
(FTD-TT-65-1892/1+2+4; AD-632314) CFSTI: HC $1.00/MF $0.50
The design and operation of a transducer for measuring stresses by the eddy-current method is described, as is its application to measurements on a series of steel specimens.
Author (TAB)

N66-29927# Assembly Products, Inc., Chesterland, Ohio.
PRODUCTION ENGINEERING MEASURE FOR METERS, TAUT-BAND SUSPENSION, A-C MOVING IRON VANE PER SIGNAL CORPS REQUIREMENTS SCS-160 Quarterly Progress Report, 1 Nov. 1965–31 Jan. 1966
R. H. Nichols [1966] 7 p
(Contract DA-36-037-AMC-01473(E))
(QR-11; AD-632455) CFSTI: HC $1.00/MF $0.50
All preproduction tests on 2 1/2-inch meters have been completed except the Group V tests on the 0–5 ampere meters. The tests were successful. Preproduction approvals have been granted for all three types of 3 1/2-inch meters. The pilot run of 3 1/2-inch, 0–2 milliampere meters has been accepted and delivered. The pilot run on 3 1/2-inch 0–150 volt meters is about 60 percent complete.
Author (TAB)

N66-29982# Army Electronics Labs., Fort Monmouth, N. J.
DEPENDENCE OF PULSE AMPLITUDE AND POLARITY ON POSITION OF ENETRY IN A SOLID-STATE PARTICLE DETECTOR
Michael Basso Mar. 1966 21 p ref
(ECOM-2680; AD-632527) CFSTI: HC $1.00/MF $0.50
The dependence of pulse height and polarity on the point of entry by an incident energetic particle on a P-N type silicon solid-state radiation detector was investigated. It is shown that the application of an external bias across the base material (P type) alters the charge carrier collection characteristics of the solid-state radiation detector sufficiently to produce these observed changes in the recorded signal. This effect is attributed to the difference in mobilities between holes and electrons generated by the incident energetic particle and the influence

of injected carriers on the space charge region. It is also shown that the collection time of charge carrier within the space charge region is not dependent on position of entry by the incident particle while the collection time of charge carriers outside the space charge region is position dependent.
Author (TAB)

N66-29979*# Michigan Univ., Ann Arbor. Dept. of Astronomy.
ORBITING CORONAGRAPH Final Report
Richard G. Teske and Orren C. Mohler May 1966 168 p refs
Its Rept.-07270-1-F
(Contract NASr-54(09))
(NASA-CR-76089) CFSTI: HC $5.00/MF $1.00 CSCL 03A

A preliminary analysis of the feasibility of an orbiting coronagraph to observe the solar chromosphere and such structures as spicules, prominences, surges, flares at the limb, and the lower E corona is reported. The observational objectives were stated as examination of these features with a high angular resolution, as free from scattered light as possible, and independent of weather. The analysis and preliminary conceptual design effort consisted of three tasks: evaluation of proposed optical designs, telescope structural design and analysis, and evaluation of candidate control techniques. Two preliminary optical designs were examined, and their performance, and structure and guidance were compared. Telescope engineering is covered in detail, and three methods of control and guidance are discussed, i.e., fixed to the vehicle, mounted to the vehicle on gimbals, and as a separately orbiting but tethered vehicle. The problems of micrometeoritic hazard, cleanliness of environment, and external occultation were discussed. It was concluded that the orbiting coronagraph is entirely feasible and within the current state of the art in all technological areas needed to design, fabricate, launch, deploy, and perform the desired observations. L.E.W.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-28523*# Mechanical Technology, Inc., Latham, N. Y.
ON ASYMPTOTIC ANALYSIS OF GASEOUS SQUEEZE-FILM BEARINGS
Coda H. T. Pan 30 Apr. 1965 25 p refs
(Contract NAS8-11678)
(NASA-CR-75680; MTI-65-TR-20) CFSTI: HC $1.00/MF $0.50 CSCL 13I

Asymptotic analysis is proposed as a method for obtaining a steady state solution of the time dependent gas lubrication equation, which is of the diffusion type, for gaseous squeeze film bearings. The analysis treats the internal region and the edge regions of the gas bearing film separately. The internal region obeys the asymptotic equation which is formally similar to the equation for the time independent self-acting gas bearing; consequently, its solution may be obtained by any of a number of methods already developed for the case of time independence. The edge region is governed by a diffusion equation with relatively simple coefficients. It is shown mathematically that the contribution of the edge region(s) in relation to the internal region can often be neglected. D.T.

N66-28544*# Midwest Research Inst., Kansas City, Mo.
COLD MOLECULAR WELDING STUDY IN ULTRA-HIGH VACUUM Final Report, 8 Oct. 1964–17 Dec. 1965
C. E. Moeller, Joe Bossert, and M. Noland 19 Nov. 1965 88 p refs
(Contract NAS9-3623)
(NASA-CR-65390) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Cold molecular welding of typical metals which are being used or considered for the Apollo mission was studied and evaluated. The coefficients of friction were determined for various metal combinations under specified conditions. Then, the metal combinations were ranked according to their likelihood of cold welding as indicated by their coefficients of friction. This rating of the 45 metal combinations is based on static breakaway friction after 300 hr of contact and short-time dynamic conditions. In addition to the ultrahigh vacuum tests for 45 metal combinations, the comparative effects of operation in air versus ultrahigh vacuum were determined for four metal combinations. The experimental program consisted of developing test chambers and conducting static and dynamic tests. The test apparatus used three pellets resting on being rotated on an annular wear track. The three pellets were rigidly mounted in a holder and supported a weight; this weight produced a 1,000-psi contact pressure between the pellets and wear surface. The design incorporated heaters for maintaining the wear surfaces at approximately 200°C. The coefficient of friction was determined by measuring the torque necessary to rotate the pellets. The mechanism was enclosed in a stainless steel chamber and evacuated with an oil-free vacuum pumping system capable of maintaining pressures in the 10^{-9} and 10^{-10} torr region. Author

N66-28588# Radio Corp. of America, Camden, N. J.
PHOTOCHEMICAL LABORATORY—PROCESSES FOR INTEGRATED-CIRCUIT MULTILAYER PRINTED WIRING
G. H. Lines, E. A. Szukalski, and F. X. Thompson *In its* Computer Progr. [1965] p 34–37 refs (See N66-28586 16-08)

The RCA Photochemical Laboratory in Camden combines precision photomechanic artwork generating techniques with chemical methods in the fabrication of multilayer printed-wiring boards. Typical 18×18-inch multilayer interconnection boards such as those used in the new RCA Spectra 70 computers provide thousands of connections. This paper describes the Lab and discusses the equipment used to develop techniques and processes that enable Camden Plant manufacturing activities to produce printed wiring boards that satisfy modern integrated-circuit applications. The capability of this facility is not limited to printed-wiring networks, but can be used for all applications requiring precise graphic delineations. Author

N66-28764*# Aerojet-General Corp., El Monte, Calif. Astronics Div.
DESIGN, FABRICATION, MODIFICATION, AND TESTING OF CRYOGENIC-SOLID COOLER, AEROJET MODEL 68 Final Engineering Report
15 Nov. 1965 58 p ref *Its* Rept.-2948
(Contracts NAS7-100; JPL-950726)
(NASA-CR-75768) CFSTI: HC $3.00/MF $0.50 CSCL 13H

For use in performing infrared detector cooling experiments, a cryogenic-solid cooler, consisting of a coolant container, fill port, vent port, heat transfer rod between the

detector and the coolant, temperature control system, and temperature sensing devices, was designed, fabricated and subsequently tested. Later modifications were: a flexible detector mount and safety valve, and the portable cooler cart. Performance characteristics of the modified cooler are listed; the operational head load, and operating life are recorded. It was concluded that the validity of the basic cryogenic-solid cooling system design has been demonstrated. Although the estimated heat loads proved to be conservative resulting in a shorter operating life (5.28 mo.) than desired, the temperature measured at the detector mount was lower than anticipated. The resultant expected life is considered within the specified limits, and the use of methane instead of nitrogen is expected to fulfill all requirements. R.Ll.

N66-28831*# Tyco Labs., Inc., Waltham, Mass.
LEAD TELLURIDE NON-MAGNETIC BONDING RESEARCH STUDY Fourth Quarterly Report, 1 Dec. 1965–28 Feb. 1966
H. E. Bates, Fritz Wald, and M. Weinstein [1966] 31 p refs
(Contract NAS5-9149) NASA-CR-75804) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The purposes of this study are (1) to define the most appropriate system and process for the reproducible fabrication of low-resistance high-strength bonds of nonmagnetic electrodes to PbTe and PbTe–SnTe thermoelectric alloys, (2) to study degradation processes in these materials, and (3) to study the junctions of these materials with their electrodes. Equilibria between Ta, PbTe, and SnTe and between W and PbTe were investigated, along with diffusion bonding of W to powdered and sintered PbTe materials. The diffusion bonding process for 3N and 3P thermoelements was scaled up for increased production of bonded elements. Author

N66-28865# Metaalinstituut TNO, Delft (Netherlands).
INVESTIGATION OF THE FLANGES FROM TWO BROKEN SHAFTS OF THE EMERGENCY FLOATATION MAIN GEAR
W. Hagg 7 Apr. 1966 14 p
(M-66-304; TDCK-45132) CFSTI: HC $1.00/MF $0.50

The cause of failure of the emergency floatation main gear shafts of a Sikorsky helicopter which crashed at sea was investigated. Details of the visual and microscopical examinations and of hardness measurements are given, and photographs of the crack areas are included. It was concluded: (1) The shaft failures were attributable primarily to hydrogen embrittlement. (2) Embrittlement resulting from tempering, if any, did not play a material part in causing fracture. N.E.N.

N66-28888# Joint Publications Research Service, Washington, D. C.
ELECTRONIC MACHING AND TREATMENT OF MATERIALS
12 May 1966 132 p refs Transl. into ENGLISH of the journal Elektronnaya Obrabotka Materialov (Kishinev), no. 2, 1965 p 1–91
(JPRS-35414; TT-66-31850) CFSTI: $4.00

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N66-28889# Joint Publications Research Service, Washington, D. C.
ELECTRON-BEAM MACHINING OF MATERIALS
N. T. Ostroverkhov and V. K. Popov *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 1–16 refs (See N66-28888 16-15) CFSTI: $4.00

A general discussion is presented on the electron beam method of machining conductor, semiconductor, and dielectric materials used in industry. The physical relationships of the electron beam with the material are determined by the penetration depth of the electrons, ratio between electron energy loss and velocity, pressure of the electron beam, and pressure of the reactive force of the material evaporated during machining; and pertinent formulas are included. An electron-beam unit is described which was developed for precision machining of conductor and dielectric materials. The electron-optical system of this unit, which operates at 50 to 100 kilovolts and up to five milliamperes, focuses the electron beam on a spot with a diameter of approximately five microns. M.W.R.

N66-28890# Joint Publications Research Service, Washington, D. C.
ON THE ROLE OF GAS CAVITY IN THE ELECTRIC EROSION OF METALS
Yu. I. Potekhin *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 17–20 refs (See N66-28888 16-15) CFSTI: $4.00

An experiment was conducted to determine the role of the collapsing bubble, formed in the passage of an electric pulse through a liquid medium, on the ejection of material during spark discharge. The method employed placed in the spark gap an amount of dielectric liquid in the form of a hanging drop which, with the aid of the gas pocket formed by the discharge, would completely eject the dielectric. Duralumin anodes were used because of their good machinability and low erosion resistance; and a dependence is reported for the shape of the anode pit and the volume of ejected material on

the distance between the electrodes. The effect of gas pocket collapse is found to have no effect on electrode material discharge in the case of duralumin anodes in technical kerosene.
M.W.R.

N66-28891# Joint Publications Research Service, Washington, D. C.
SYNTHESIS OF THE SYSTEM OF DIGITAL PRESET CONTROL FOR A PRECISION ELECTRIC SPARK UNIT
K. K. Gularyan and Ye. V. Gusev *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 21–33 refs (See N66-28888 16-15) CFSTI: $4.00

A digital preset automatic control system is examined for the electric-spark machining of articles which contain straight line segments. During machining of conductor materials short circuits appear in the spark gap, and feedback systems which record the absolute value of the coordinates are recommended for the removal of these short circuits. In order to eliminate the need for position pickups of a very high capacity, the maximum value per frame is limited to 0.99 mm. The program, although lengthened because of this limitation, eliminates a large number of memory elements and simplifies the input and storage of information. Braking feed motors and blocking the system during electronic and mechanical program changes are discussed, and design of the logic circuit is detailed. While the proposed system has a minimum number of elements and a higher reliability, it requires extremely complex programming for articles which consist of curve segments.
M.W.R.

N66-28892# Joint Publications Research Service, Washington, D. C.
STRUCTURAL CHANGES OF METAL AFTER ELECTRIC-SPARK ALLOYING
Yu. N. Petrov, I. I. Safronov, and Yu. P. Kaloglu *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 34–45 refs (See N66-28888 16-15) CFSTI: $4.00

The effect of temperature field during electric spark discharge on the formation of new phases and structures of metal alloy surfaces is investigated with various samples of steel. Alloying electrodes used are hastelloy-D a graphite, and a tungsten–titanium hard alloy designated T15K6; and thermal analyses were made on all the samples. Microhardness did not change for layer sections with a large amount of carbides which were tempered to 550°C. The white carbide layer formed by surface-alloying with T15K6 retains its structure and hardness when heated to 850°C. The layer-by-layer structural and phase transformation of the metal surface after electric-spark alloying indicates that layer structure is both temperature and time dependent.
M.W.R.

N66-28896# Joint Publications Research Service, Washington, D. C.
INCREASE OF WEAR RESISTANCE OF COMPRESSION MOLDS FOR RUBBER TECHNICAL ARTICLES BY ELECTRIC SPARK ALLOYING
N. I. Lazarenko and S. T. Novikov *In its* Electron. Machining and Treat. of Mater. 12 May 1966 p 116–120 refs (See N66-28888 16-15) CFSTI: $4.00

An electric spark discharge alloying method, using a hard titanium–tungsten alloy designated grade T15K6, is found to save considerable money by reducing the number of compression molds used in the production of rubber articles. The hardened alloy surface on steel is between three and 30 microns, and worn edges of the compression molds can be readily restored to useable condition. This alloying technique has also been used in rubber-tube cutting machine for hardening cone centers which wear out rapidly from friction against the rubber tube.
M.W.R.

N66-28968# Minnesota Mining and Mfg. Co., St. Paul, Minn.
FABRICATION OF TUNGSTEN ALLOY TUBING Progress Report, 23 Oct. 1965–1 Feb. 1966
H. G. Sowman, A. Milner, and D. D. Rowenhorst 10 Feb. 1966 8 p ref
(Contract AT(11-1)-1518)
(COO-1518-2) CFSTI: HC $1.00/MF $0.50

Small dia W–26 at % Re tubing and W–30 at % Mo–30 at % Re rod was fabricated by the plastic extrusion of mixtures of the elemental powders and organic binders followed by sintering. Both tubing and rod were ductile in the as-sintered condition.
Author (NSA)

N66-29028# Atomic Weapons Research Establishment, Aldermaston (England).
A SYSTEM FOR DRIVING A METAL PLATE AT 1000 M/S
J. H. Price and J. K. Yates Feb. 1966 11 p refs
(AWRE-O-21/66) HMSO: 2s 6d

Previously, experiments were described which involved driving a flat metal plate face-on at speeds of about 1000 m/s. Design principles, details of construction, and the setting-up procedure for the particular system used are included. NSA

N66-29077*# Hughes Aircraft Co., Culver City, Calif. Materials Technology Dept.
STUDY OF SPACE ENVIRONMENT FABRICATION AND REPAIR TECHNIQUES Summary Report, Period Ending Apr. 1966
R. D. Engquist and D. B. Nord May 1966 52 p
(Contract NAS9-4548)
(NASA-CR-65402) CFSTI: HC $3.00/MF $0.50 CSCL 13H

Various joining systems were evaluated for potential application to the fabrication of structures in an extraterrestrial environment. These systems include (1) electron beam welding; (2) resistance welding; (3) thermochemical brazing; (4) adhesive bonding; (5) solid state joining (diffusion bonding, pressure welding, and explosive bonding); (6) gas fusion welding; (7) arc welding; (8) focused sunlight joining; and (9) laser welding. Based on laboratory and state-of-the-art investigations, electron beam and resistance welding were chosen as the two systems with the most likely chances of success. In addition, various energy systems which could be used with electron beam and resistance joining were evaluated. Among these are (1) solar cell/battery systems; (2) fuel cells; and (3) nuclear reactor systems.
D.T.

N66-29185# Watervliet Arsenal, N. Y. Benet Labs.
APPLICATION OF SHEAR-SPINNING TECHNIQUES IN FORMING MOLYBDENUM MISSILE COMPONENTS
Charles H. Rose Mar. 1966 29 p
(WVT-6604; AD-631423) CFSTI: HC $2.00/MF $0.50

The report covers the development of a spinning process for the manufacture of missile nose tips made of T.Z.M. molybdenum. The design of preforms, tooling and the manufacturing processes are explained. The complete material flow from rough sheet to finished nose tip is described. Results of this effort have shown that shear-spinning is a

feasible and practical method of producing hemispherical components from T.Z.M. material, and where a variable wall thickness is required, shear-spinning presents the only feasible method of manufacture. Author (TAB)

N66-29223*# Aerojet-General Corp., Sacramento, Calif.
INDUCTION PROCESSED SEPARABLE TUBULAR BRAZED CONNECTORS
V. Hunt Washington, NASA, Jul. 1966 32 p *Its* Rept.-8800-24 (Contract NAS3-2555)
(NASA-CR-515) CFSTI: HC $2.00/MF $0.50 CSCL 13H

Methods for producing separable tube joints, other than mechanical, were investigated for application of these joints to the M-1 engine lines. The induction process was selected for brazing the separable tube connectors. Special plier-type induction brazing tools were made to permit the brazing of M-1 thrust chamber transition tube joints to the fuel torus. An 82% gold–18% nickel brazing alloy was used with a brazing temperature range of 1900°F to 1950°F. The tubes and sleeves in this application were of 0.032-in. wall AISI, Type 347 stainless steel. Author

N66-29232# Sperry Rand Corp., Gainesville, Fla. Electronic Tube Div.
LOW-TEMPERATURE REFRACTORY METAL-TO-CERAMIC SEALS Final Report, 1 Jan. 1964–15 Jan. 1966
L. A. Tentarelli, J. M. White, and R. W. Buck Apr. 1966 258 p refs
(Contract DA-36-039-AMC-03734(E))
(NJ-2769-0167-8; ECOM-03734-F; AD-632362) CFSTI: HC $6.00/MF $1.25

The report covers a two-year study on low temperature refractory metal-to-ceramic seals. The development phase was concerned with: the effect of process variables; effects of ball milling on particle size and seal strength; effects of changes in Mn concentration and the effects of compositional changes in the W, Mn, Fe metalizing system. Low-temperature mixes were adapted to silk screen and transfer tape metalizing techniques. Seal reliability was studied through heat cycling experiments. Numerous suspension mixes as well as metalizing solutions were investigated. The low-temperature process was found satisfactory on various alumina and beryllia bodies. Solution metalizing investigations were concerned with: concentration of salts; thickening agents and solution stability. Feasibility of the low-temperature process was demonstrated by the fabrication of a number of hermetic seals used in production tubes. A comparison of low-temperature metalizing with conventional Mo/Mn metalizing process is presented. A theoretical phase involved: electron probe analysis of low temperature metal–ceramic interface; X-ray diffraction techniques to detect compounds formed at the interface; various experiments designed to synthesize compounds formed at the interface, and micrographic and electron microscope techniques to detect internal microstructural changes that occur in a ceramic during heat cycling. Author (TAB)

N66-29519*# Mechanical Technology, Inc., Latham, N. Y.
ANALYSIS OF THE PRESSURE LOSS CHARACTERISTICS OF THE GAS FEEDING REGIONS OF THE NASA AB-5 GYRO GIMBAL BEARING
John H. Vohr Aug. 1963 41 p refs
(Contract NAS8-5154)
(NASA-CR-75867; MTI-63TR35) CFSTI: HC $2.00/MF $0.50 CSCL 13I

The problem of analyzing the flow in the vicinity of the point where gas is fed into an externally pressurized gas bearing is discussed. The feeding characteristics of hydrostatic bearings for the cases of subsonic flow and supersonic flow are treated individually. When analyzing subsonic flow, it was determined that the total pressure loss occurring in the entrance region cannot be predicted exactly analytically; however, a semi-empirical equation was derived which relates the total pressure loss over the entrance region to the mass flow rate through the bearing. The phenomenon of supersonic flow appeared to be susceptible to accurate analytical prediction. One complication that may arise is that in the subsonic flow regime just downstream of the shock transition, inertia forces may be significant in the flow. A first order correction to account for these forces is suggested. It is stated that the equations developed for each of these cases can be applied to determine the feeding characteristics of the AB-5 bearing. H.S.W.

N66-29643*# Southwest Research Inst., San Antonio, Tex.
FABRICATION AND TESTING OF BATTERY SEPARATOR MATERIAL FROM MODIFIED POLYETHYLENE Final Report
L. M. Adams, W. W. Harlowe, Jr., and G. C. Lawreson 7 Jun. 1966 67 p refs Prepared for JPL
(Contract NAS7-100; SwRI Proj. 01-1842)
(NASA-CR-75951) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Approximately 200 ft of polyethylene film, crosslinked, grafted, and subsequently regrafted, was evaluated. The regrafting, a deviation from the initially established procedure, was necessary since insufficient grafting took place during the initial operation. A summary of the films and their respective properties is tabulated. The key to the film nomenclature and test sample procedure used is included in Appendix A. The films exhibited satisfactory resistance values after sterilization. Exceptions appear to be the result of nonuniformity of grafting. The tensile strength values were generally lower than the specified minimum of 700 psi, possibly because of degradation resulting from the irradiation dosage required for regrafting. Author

N66-29647# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.
APPLICATION OF ADVANCED FIBROUS REINFORCEMENT COMPOSITE MATERIALS Monthly Progress Report, 1–30 Apr. 1966
20 May 1966 45 p
(Contract AF 33(615)-3262)

This report includes activities in the development and application of boron filament reinforced polymer and metallic base composites; pay-off and associated studies for the use of composite components in aircraft gas turbine engines; and the demonstration of several key components including compressor blades, vanes, and integral rotors. The objectives, accomplishments, and future plans of the various areas of activity are presented. Author

N66-29668# Joint Publications Research Service, Washington, D. C.
FOURTH ALL-UNION SCIENTIFIC AND TECHNICAL CONFERENCE ON QUALITY CONTROL AND NON-DESTRUCTIVE TESTING
B. S. Fayerman 24 Jun. 1966 10 p Transl. into ENGLISH from Zavodsk. Lab. (Moscow), no. 1, Jan. 1966 p 126–128 Conf. held at Kishinev, USSR, 14–16 Oct. 1965
(JPRS-36183; TT-66-32017) CFSTI: $1.00

Conference reports on theoretical and technological developments in the areas of quality control and nondestructive testing are reviewed. Problems connected with developing introscopy and defectoscopy techniques are discussed in relation to the work done by several institutes. These included betatron flaw detectors for introscopic examination; and X-ray, electromagnetic, and ultrasonic methods for defectoscopic studies. Nondestructive testing methods such as magnetic checking and flaw detection are discussed; and various applications of eddy currents for product control are cited. S.P.

N66-29566*# Republic Aviation Corp., Farmingdale, N. Y. Manufacturing Research Dept.
MAGNETIC FORMING COIL DESIGN AND DEVELOPMENT Final Summary Report, 17 Jun. 1963-31 Mar. 1964
N. Inman, G. Pfanner, and F. Smith Mar. 1964 67 p refs /ts Rept. -63-69-1
(Contract NAS8-5435)
(NASA-CR-75978; RAC-2214) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Details are given on magnetic forming experiments, conducted with two capacitor bank installations operable to 39,000 and 155,000 joules respectively. Efforts centered on developing coils and techniques for the corrective forming of panels which have distortions such as occur in welding. Two integrally stiffened panels were used in the experiments: one had both inward distortion effects at the weld to a rather serious degree, and a considerable amount of outward distortion centered 2 feet away from the weld; the other was inwardly distorted only in the longitudinal direction at the weld. Development work on the coils, coil holders, damping and attaching devices, corrective forming techniques, and coil destruction tests are described. Results indicate the practicality of using magnetic coils, which are simply attached to workpieces by vacuum or mechanical fasteners, for corrective forming. It was also found that contact between the forming coil and workpiece is obtained by the inertia effect of the high energy forming impulse rather than by structure. It was generally concluded that the magnetic forming technique can be used to reform relatively heavy gauge aluminum components in the field. M.G.J.

N66-29684*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF PROTECTIVE FINISHES FOR GLASS MONOFILAMENTS Final Report
J. Shulman, S. L. Kaplan, and H. P. Beutner 3 Mar. 1966 86 p refs
(Contract NAS3-4182)
(NASA-CR-54774; ADL-C-66368) CFSTI: HC $3.00/MF $0.75 CSCL 11C

Several organic finishes and a nickel-metal finish have been studied to determine their effect in preventing degradation of the strength of glass filaments in resin-glass composites. "HTS-simulated" finish glass was used as the control in comparing the new finishes. Laboratory apparatus was assembled for continuously applying nickel to the glass filament as it was being drawn from the bushing. Author

N66-29686# United States Rubber Co., Mishawaka, Ind.
LINERS FOR HIGH PRESSURE AIR STORAGE VESSELS Quarterly Progress Report, 1 Jan.-1 Apr. 1966
E. C. Uhlig, V. A. Falkenau, and R. C. Kohrn [1966] 37 p
(Contract NObs-92150)
(QPR-5; AD-632092) CFSTI: HC $2.00/MF $0.50

The practicability of fabricating and using a thin, deformed, electrodeposited nickel-tin-nickel laminate as a storage lining material is being studied, and leak testing was conducted on three air storage test vessels to determine suitable lining materials. Analytical details of liner properties determined from testing and fabricating the vessels are presented in tabular form. The first test vessel, pressurized with air at the rate of 500 psi per minute, showed two sources of leakage; these were traced to porous fittings around the welded areas, and a break in the electroformed liner. Pressure cycling control between 2000 psi and 5000 psi was conducted on a second vessel, which was leak tested to 2000 psi and proof tested to 9500 psi. Dissection showed the cause of leakage to be delamination between nickel liner layers, and directional buckling in the liner. Data analyzed for the third vessel indicated that the system lost 2000 psi pressure in 15 minutes which substantiated that the test vessel had developed a liner failure. A revised high pressure air storage vessel test plan is included. R.I.

N66-29690# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW METHOD OF EVALUATING THE EFFECTIVENESS OF ACTION OF ANTI-SCORING ADMIXTURES TO OILS AND FUELS
K. I. Klimov, A. V. Vilenkin, and G. I. Kichkin 23 Mar. 1966 15 p refs Transl. into ENGLISH from Tr. Vsesoyuznoye Nauchno-Tekhn. Soveshch. po Prisadkam k Maslam i Toplivam, 1960 (USSR), 1961 p 273-278
(FTD-TT-65-1491/1+2+4; AD-631838) CFSTI: HC $1.00/MF $0.50

To evaluate anti-scoring properties of lubricating materials an essentially new type of friction machine having a pair of intersecting cylinders and periodic surface contact was developed and proposed. The necessity of relative evaluation of anti-scoring properties of oils containing admixtures on friction machines in order to model the testing conditions by the sliding rate, contact periodicity and temperature in a wide range of their changes is shown. A method was developed for the relative evaluation of anti-scoring properties of lubrication materials in conditions that model real conditions of oil operation. Anti-scoring properties of certain petroleum products in pure form, and with admixtures were investigated. It was shown that the proposed instrument and evaluation method have a high sensitivity in comparison with other methods and instruments. Author (TAB)

N66-29710*# Lockheed-Georgia Co., Marietta. Nuclear Lab.
FABRICATION AND TESTING OF BATTERY SEPARATOR MATERIAL FOR THE JET PROPULSION LABORATORY
Apr. 1966 36 p Prepared for JPL
(Contract NAS7-100; JPL-CA-384807)
(NASA-CR-75980; ER-8487) CFSTI: HC $2.00/MF $0.50 CSCL 13H

A battery separator was prepared by crosslinking polyethylene film with divinylbenzene followed by grafting with acrylic acid using gamma irradiation to effect the crosslinking and grafting. Measurements of physical dimension changes, resulting from multiple sterilization cycles in 40 percent potassium hydroxide solution at 145°C, were made by infrared spectroscopy of the absorbance ratio between the carboxyl group and the methylene group. Also tested were wet tensile strength and electrical resistance of the separator. Details of the processing procedures for approximately 240 lineal feet of battery separator material are presented together with descriptions and results on the performed stability tests. G.S.

N66-29794# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANIZATION AND AUTOMATION OF GAS TURBINE ENGINE BLADE MANUFACTURE
V. A. Maksimov 23 Mar. 1966 21 p Transl. into ENGLISH from Avtomatiz. Protsessov Mashinostr. Obrabotka Rezaniyem Uprochneniye i Sborka (USSR), v. 3, 1963 p 85–90
(FTD-TT-65-1492/1+4; AD-631578) CFSTI: HC $1.60/MF $0.50

Complex mechanization of blade preparation should embrace all stages of industry from the obtainment of billets to the control of ready blades. Adoption of billets without allowances for the processing by feather profile enables rapid solution of problems of mechanization and automation of mechanical machining processes which is very simplified in this case. Completion of the creation of special equipment will enable mechanization of all operations which will eliminate manual labor, still used in individual operations. By further improving the process of manufacturing blades of compressors and turbines, there should appear automation of mechanical processing, the advisability of which was confirmed by the experimental tasks. Author (TAB)

N66-29812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEXTBOOK ON PIPES AND TANKS
B. I. Panchenko, ed. [1964] 215 p Transl. into ENGLISH of the book "Spravochnik na Truby i ballony" Moscow, Metallurgizdat., 1957 p 5–176
(FTD-TT-64-1254/1+2; TT-65-63026; AD-619422) CFSTI: HC $6.00/MF $1.25

The handbook gives the characteristics of steel and cast iron piping and compressed-gas cylinders; technical-specification requirements for production and procurement are given. The book is intended for industrial engineering and technical workers, designers and planners, builders, administrative workers and personnel in technical purchasing and marketing divisions. Author (TAB)

N66-29824# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF TECHNICAL PROGRESS IN MACHINE CONSTRUCTION OF THE REPUBLIC
S. Minasyan 24 Aug. 1965 12 p Transl. into ENGLISH from Prom. Armenii, Gos. Nauchn.-Tekhn. Kom. Sov. Min. Arm. SSR (Erevan), no. 2, 1962 p 7–10
(FTD-TT-65-438/1+4; TT-65-63823; AD-620766) CFSTI: HC $1.00/MF $0.50

The feasibility of using plastics in the construction of machines is discussed. TAB

N66-29910*# Boeing Co., Seattle, Wash. Aerospace Group.
IDENTIFYING OPTIMUM PARAMETERS OF HOT EXTRUSIONS Interim Report No. II
Roy W. Rice and James G. Hunt (Nucl. Metals, Inc.) 3 May 1966 105 p refs Prepared jointly with Nucl. Metals, Inc.
(Contract NAS7-276)
(NASA-CR-76057) CFSTI: HC $4.00/MF $0.75 CSCL 13H

The purpose of this program is to develop a technique for hot extruding MgO and to determine the effect of hot extrusion on MgO. Preliminary evaluations of the effects of extrusion will be made on other oxide bodies. Crack free MgO extrusions were obtained from 1"-diameter billets in a 1", thick-wall tungsten can, while extrusion of 1.5" diameter billets in a 0.75"-thick-wall can were cracked. Extrusion into a catch tube heated to 2000°C (3635°F) reduced, but did not eliminate cracking. The mechanism of cracking appears to be either excessive shear or thermal stress of the ceramic, with the latter favored. Testing of extruded MgO showed that its strength is 50% or more, greater than hot pressed MgO of equivalent grain size. The increase in strength was shown to be due to decreased misorientation of grains by the ⟨100⟩ axial texturing. The extruded material obeyed the Petch relationship. Fracture texture of the extruded MgO allowed fracture origins to be detected, which, along with strength analysis, showed that crack nucleation by dislocation pile-up at grain boundaries occurs in extruded MgO, and is probably the controlling factor in the strength of all dense MgO of adequate purity and flaw content. Extruded bodies, especially those without cracks, were found to have residual stresses. This apparently was the cause of weakening of the bodies by chemical polishing. Annealing for 1 hour at 2200°F (1205°C) relieved these stresses. Author

N66-29944# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
A BASIC STUDY OF THE SLIDING CONTACTS IN ROLLER BEARINGS Quarterly Progress Report No. 4, 16 Jan.–15 Apr. 1966
Chester J. Belsky, M. Cocks, and W. E. Schmidt [1966] 86 p refs
(Contract NOw-65-0182-f)
(AL66L026; AD-632493) CFSTI: HC $3.00/MF $0.75

A study was made of the kinematics of a flat washer to roller test configuration. Author (TAB)

N66-29988*# Air Reduction Co., Inc., Murray Hill, N. J. Research and Engineering Dept.
TOFLOX SYNTHESIZER STUDY Final Report, May 27, 1965–Jan. 31, 1966
John J. Sima 13 May 1966 126 p
(Contract NAS8-20099)
(NASA-CR-76071; RE-66-085-CRE-36) CFSTI: HC $4.00/MF $1.00 CSCL 13H

Equipment has been developed for the pilot production of 0.05–0.10% O_3F_2 in LO_2 (TOFLOX) in 25 gal. batch quantities. The equipment, now being operated at Huntsville, demonstrates that TOFLOX can be made reliably and safely on an engineering scale. This report contains information necessary for the operation and maintenance of that equipment. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-28553# TRG, Inc., Melville, N. Y.
RESEARCH ON PROPERTIES OF LASER DEVICES Final Technical Summary Report, 15 Nov. 1964–15 May 1965
N. Solimene, ed. [1965] 65 p refs
(Contract AF 49(638)-1535; ARPA Order 358; Proj. Defender)
(TRG-034-TR-1; AD-627353) CFSTI: HC $3.00/MF $0.75

CONTENTS:
1. MANGANESE COLLISION LASER p 3–9 refs
2. RARE EARTH COLLISION LASER p 10–15 refs

3. PHOTODISSOCIATION LASERS p 16–26 refs
4. THERMO-OPTICAL EFFECTS IN SOLID-STATE LASER MEDIA p 27
5. LASER PUMPING LASER p 28–33
6. DYNAMIC OPTICAL PATH DISTORTIONS IN LASER RODS S. D. Sims, A. Stein, and C. Roth 16 p (See N66-28554 16-16)
7. END PUMPING OF AN R_1 RUBY LASER BY AN R_2 RUBY LASER 7 p (See N66-28555 16-16)

N66-28554# TRG, Inc., Melville, N. Y.
DYNAMIC OPTICAL PATH DISTORTIONS IN LASER RODS
S. D. Sims, A. Stein, and C. Roth *In its* Res. on Properties of Laser Devices [1965] 16 p (See N66-28553 16-16) CFSTI: HC $3.00/MF $0.75
(Contract Nonr-3833(00))

High quality ruby crystals and improved glass laser materials doped with neodymium were investigated in order to study optical path distortions in laser rods. It was found that significant distortions were introduced as a result of thermal gradient evolution during the optical pumping cycle. Since laser action occurs only during the pumping pulse, or shortly thereafter in the case of Q-switching, primary emphasis was placed on the time interval of the pumping pulse. Thus a Q-switched laser was found to be a highly effective interferometer illumination source in cases where high time resolution is desired. A side benefit from the use of this technique was that the resulting observations are almost precisely reproducible from shot to shot. Thereafter, it is noted, optical correction can be employed to improve resonator performance at any desired time. This is particularly useful in Q-switching lasers, where the resonator characteristics need only be good during the development of the output pulse. D.T.

N66-28555# TRG, Inc., Melville, N. Y.
END PUMPING OF AN R_1 RUBY LASER BY AN R_2 RUBY LASER
In its Res. on Properties of Laser Devices [1965] 7 p (See N66-28553 16-16)
CFSTI: HC $3.00/MF $0.75

An analysis and steady state solution are given for a proposed experiment in which an R_2 ruby laser is to be used to pump an R_1 ruby laser. This technique is to provide a means for reducing optical path distortions, caused by thermal gradient evolution, by decreasing to a minimum the pump light which must be absorbed. In this case, very little heat deposition is expected. Consequently, it is noted, the radiance of the R_1 laser should be improved to whatever extent its performance had been limited by thermal effects. D.T.

N66-28729# Korad Corp., Santa Monica, Calif.
GaAs LASER DIODES Final Report, 1 Jul. 1964–30 Jun. 1965
R. A. Sehr and W. J. Rundle Jan. 1966 28 p refs
(Contract DA-28-043-AMC-00235(E))
(AD-478538)

Refinements in the experimental technique for growing p–n junctions from liquid solution resulted in highly uniform and dislocation-free n-layers on p-substrates. High pressure diffused laser diodes were fabricated with thresholds between 50 and 70 amperes at 300°K, and typical power outputs of two watts with 50 nsec pulses and a repetition rate of 1000 pps. Some lasers, mounted on special headers containing a pulse transformer, were operated at 9000 pps with 100 nsec pulses producing a beam of 1.5 watt optical peak power within a beam angle of 12°. Author (TAB)

N66-28923# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 2, NUMBER 5 May 1966 58 p refs

CONTENTS:
1. LASER WITH A NONRESONANT FEEDBACK C. Shishkevich p 1–6 refs (See N66-28924 16-16)
2. GROWTH OF SILICON CARBIDE SINGLE CRYSTALS J. G. Kourilo p 7–15 refs (See N66-28925 16-26)

SCIENCE & TECHNOLOGY NOTES
a. OBSERVATIONS OF SKY-ILLUMINATION PHENOMENA FROM SPACESHIPS p 16–19 refs
b. RT-15 RADIO TELESCOPE p 20–22
c. THE EFFECT OF NUCLEAR REACTOR RADIATION ON THE OPERATION OF A CESIUM DIODE p 23–27
d. A 625-KJ CAPACITOR BANK FOR THE PRODUCTION OF HIGH-INTENSITY MAGNETIC FIELDS p 27–29 refs
e. TRIS(TRIALKYLSILYL) ANTIMONITES p 29–30
f. POLYMERIZATION OF MONOMERS COMPLEXED AND ORGANIZED ALONG CERTAIN PATTERNS p 31–33 refs
g. ULTRABASIC ROCKS FROM THE BOTTOM OF THE INDIAN OCEAN p 34–35

CONFERENCES
a. SESSION OF THE DEPARTMENT OF GENERAL AND APPLIED PHYSICS OF THE RADIOTECHNICAL INSTITUTE p 36–38
b. SEMINAR ON MAGNETIC-TELLURIC METHODS OF STUDYING THE EARTH'S CRUST AND MANTLE p 38–39

3. SCIENCE PERSONALITIES: N. M. EMANUEL' p 40–41
4. BOOK REVIEWS p 42–50 refs

N66-28924# Library of Congress, Washington, D. C. Aerospace Technology Div.
LASER WITH A NONRESONANT FEEDBACK
Charles Shishkevish *In its* Foreign Sci. Bull., Vol. 2, No. 5 May 1966 p 1–6 refs (See N66-28924 16-16)

A laser with a nonresonant feedback is described. The active medium consists of two ruby rods, and one or both of the external mirrors of the laser are replaced by a volume or surface scatterer. The only resonant element in the system is the spectral line. The emission of the device is highly monochromatic but is not spatially coherent. It is shown that this system can be used as a frequency standard for the optical part of the spectrum. Author

N66-29032# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MULTIPHOTON PROCESSES BROUGHT ABOUT BY A LASER [PROCESSUS MULTIPHOTONIQUES PROVOQUES PAR UN LASER]
Pierre Nelson Dec. 1965 24 p refs In FRENCH
(CEA-R-2868)

The critical intensity characterizing the multiphoton processes is calculated. The multiphoton effects corresponding to the Compton scattering, the bremsstrahlung, and the photoelectric effect are investigated. The cross sections are evaluated. It is shown how the introduction of a refracti

index, in clothing the photons, allows the elimination of the infrared divergence. The theory seems consistent with experiment. Author (NSA)

N66-29249# Boston Coll., Chestnut Hill, Mass.
AN INVESTIGATION OF PROPERTIES OF THE LASER MICROPROBE Final Report (Part I), 1 Jul. 1964–13 Aug. 1965
James J. Devlin and Anthony B. La Conti 13 Aug. 1965 89 p refs
(Contract AF 19(604)-8819)
(AFCRL-65-855(I); AD-632416) CFSTI: HC $3.00/MF $0.75

An investigation of the laser microprobe as a source for emission spectrochemical analysis is reported. The size and character of the crater: burnt into a number of pure element metals was investigated. Working curves for a series of iron and aluminum alloys were produced. This gave a measure of the sensitivity and reproducibility of the laser microprobe. Author (TAB)

N66-29428*# National Aeronautics and Space Administration, Washington, D. C.
OPTICAL LOCATION OF THE MOON [OB OPTICHESKOY LOKATSII LUNY]
A. Z. Grasyuk, V. S. Zuyev, Yu. L. Kokurin, P. G. Kryukov, and V. V. Kurbasov et al May 1964 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 154, no. 6, 1964 p 1303–1305 Presented at the Joint Colloq. of the Oscillations Lab. of Quantum Radiophysics, USSR, 28 Sep. 1963
(NASA-TT-F-8866) CFSTI: HC $1.00/MF $0.50 CSCL 20E

The preliminary results of locating the moon with the aid of a ruby laser are presented. A schematic representation of the apparatus used is included. A single telescope was used for both transmitting and receiving the light pulses. A preliminary estimate of signal-to-noise ratio was made. The results of measurements made on September 13, 1963 are included. The chosen target was the crater Albategnius on the dark part of the moon. The value of the signal received was four times greater than the root mean square error in measuring the background, and therefore cannot be ascribed to background fluctuations; the measurements permitted reliable registration of signals reflected from the moon. R.T.K.

N66-29552# Joint Publications Research Service, Washington, D. C.
PROSPECTS FOR LASER AND OPTICAL COMMUNICATIONS
R. Svoren' 21 Jun. 1966 25 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 4, Apr. 1966 p 59–65
(JPRS-36111; TT-66-32545) CFSTI: $1.00

Technological developments and future prospects of lasers and their applications, particularly as radio receivers and transmitters, in optical communications are discussed in a very general way. Among the advantageous characteristics cited for lasers are: (1) The spatial coherence of the laser beam facilitates electromagnetic radiation in only one direction and this property permits a large number of lasers to operate on the same frequency. (2) Lasers generate waves in the optical range of frequencies (infrared, light and ultraviolet), and operate on an unlimited frequency band. (3) The sharp laser beam can be achieved with relatively small emitters, and the ability to emit sinusoidal electromagnetic waves makes it possible to load the laser beam with information, as in radio transmission. Thus, although utilized to a limited extent now, a single, multi-channel laser beam could carry all television and radio programs, radar signals, remote control, and telemetering. The greatest danger in optical communications is that transmission can vary greatly since the propagation range of a light beam is sharply reduced under unfavorable meteorological conditions; this is considered to be the chief obstacle to constructing an earthbound communications link. R.LI.

N66-29797# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET LASERS
23 Mar. 1966 10 p Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), no. 4, 1965 p 86–87
(FTD-TT-65-1953/1+4; AD-631583) CFSTI: HC $1.10/MF $0.50

The following Soviet lasers, presumably on exhibit at the Leipzig fair, are mentioned. A laser with 100-mv power attainable with one hundred millioneth part of a second for detection of cosmic ships in space and for heating plasma. Laser GOR-100, with an unignited light ray that burns holes in steel plates. Razdan laser, operating continuously at 2 light pulses/sec. Laser OK-1, a ruby laser whose thousandth part of a second ray welds the unstuck retina of the eye. SU-1 device that microweldes the parts of precision apparatus that melt with difficulty. The Lucz-3 miniature semiconductive device that transforms solar light into electricity which in turn is transformed into amplifier laser light. The computer device at Manhasset in New York State computes from meteorological data the best routes for travel between Europe and America. TAB

N66-29847# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
UTILIZATION OF MASER AS A MEANS OF EXCITATION FOR THE SPECTROGRAPHIC EXAMINATION OF MICROSTRUCTURES OF METALS Final Report
M. D. Smith and J. F. Danovich 31 Dec. 1965 17 p refs
(AD-632240) CFSTI: HC $1.00/MF $0.50

Investigation of laser as a source of excitation for emission spectroscopy and techniques developed for its use in this capacity are reported. Results of qualitative detection of segregates and inclusions in metallic alloys and the limits of detection of various elements in aluminum standards by the techniques developed are presented in addition to investigations of this means of excitation for the analysis of ceramics and refractories. It is concluded that the results of investigation show the feasibility of the use of the laser microprobe as a means of excitation for emission spectrography. The techniques developed in the analysis of coatings and modifications of the objective lens have increased the versatility and scope of application. Although the laser microprobe offers many advantages over the arc-spark spectrographic source, it nevertheless possesses certain limitations which require that it be considered as a complementary accessory to extend the applications of emission spectroscopy. Author (TAB)

N66-29884# Illinois Univ., Urbana. Electro-Physics Lab.
GAS LASER STUDIES IN THE 100 to 1000 MICRON RANGE Final Report
Paul D. Coleman 31 Dec. 1965 11 p refs
(Grant AF-AFOSR-804-65)
(AFOSR-66-0719; AD-632306) CFSTI: HC $1.00/MF $0.50

The report summarizes the first year's activities of research on gas lasers in the 100 to 1000 micron range. A general description and experimental results of a water vapor laser

covering the 48 to 118 micron range is described. Research problems to be explored during the second year of the grant are discussed along with a brief comparison with classical electronic methods of generation. Author (TAB)

N66-29965# Naval Ordnance Lab., White Oak, Md.
SOME EXPLORATORY EXPERIMENTS ON LASER EXPLOSIONS IN PSEUDO-AIR
Thomas W. Hill and Leonard Rudlin 1 Mar. 1966 31 p refs
(NOLTR-65-152; AD-632484) CFSTI: HC $2.00/MF $0.50

A Q-switched ruby laser, which cannot explode air directly, has been used to explode various pseudo-air targets. These targets have been, generally, air with increased electron densities, such as a drop of liquid nitrogen or an air-plasma caused by a spark gap. Water drops, to which were added various salts, were also targets in evaluating the feasibility of salting targets. The results consisting of open-shutter photographs, time-integrated spectra, and some photodiode records with micro-second resolution suggest that: (1) twelve spectral lines are found common to nearly all the targets; identification suggests that these lines originate in the air surrounding the targets; (2) the structure of the spectrum resulting from laser interaction with a drop of liquid nitrogen has marked similarity to the structure of lightning spectra; further, most of the twelve lines common to nearly all spectra appear in lightning spectra; (3) the luminous phenomena occur over times like micro seconds from the laser pulses of duration like tens of nanoseconds; and (4) further experiments with nanosecond-to-shake time resolution are needed to clarify the 'explosion' details. Author (TAB)

N66-29984# Joint Publications Research Service, Washington, D. C.
COHERENT LIGHT GENERATORS AND AMPLIFIERS
F. A. Korolev 30 Jun. 1966 30 p Transl. into ENGLISH from Elektrichestvo (Moscow), no. 4, Apr. 1966 p 1-11
(JPRS-36295; TT-66-32727) CFSTI: $1.00

The most fundamental points connected with quantum generation and light intensification are elucidated. The theory and instrumentation of various coherent light amplifiers are described. The advantages and applications of these lasers are indicated. N.E.N.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-28512*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A STUDY OF TUNGSTEN-TECHNETIUM ALLOYS Quarterly Progress Report, Oct. 1, 1965-Jan. 1, 1966
3 Jan. 1966 15 p Sponsored by NASA
(Contract AT(45-1)-1830)
(NASA-CR-75541; BNWL-196) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Illustrations of the fracture surfaces of Tc-W alloys revealing the effects of Tc content on the cast grain structures, results of density measurements of Tc-W alloys of different compositions, and a description of the technique used to hot roll pure Tc are presented. NSA

N66-28519*# Pittsburgh Univ., Pa.
A NUMERICAL ANALYSIS OF HYSTERESIS AND EDDY CURRENT LOSSES IN SOLID CYLINDRICAL RODS OF #1010 STEEL
M. D. Abrams and D. H. Gillott New York, IEEE [1966] 20 p refs Presented at IEEE Summer Power Meeting, New Orleans, 10-15 Jul. 1966
(Grants NsG(T)-70; NSF GP-3086; NSF GP-11309)
(NASA-CR-75741; IEEE Paper-31-PP-66-434) CFSTI: HC $1.00/MF $0.50 CSCL 11F

A computer procedure, previously written for determining the phase and intensity of magnetic field penetration into ferromagnetic materials, was used specifically to analyze the losses in a cylindrical rod of #1010 steel. The rod was subjected to a sinusoidally varying 60 cycles per second magnetic field. The calculated values of eddy current loss, hysteresis loss, and total core loss for three values—20, 50, and 80 oersteds—of applied magnetic field intensity are: (1) eddy current: 9.60, 49.14, and 68.34 watts; (2) hysteresis: 5.32, 6.78, and 7.10 watts; and (3) total core: 14.92, 55.92, and 75.44 watts. Some engineering applications of this method are suggested, including losses in end plates of rotating machines; and losses in solid iron rotors of turbine generators. D.T.

N66-28526# Oak Ridge National Lab., Tenn.
CONFERENCE ON THE PHYSICAL METALLURGY OF BERYLLIUM
Washington, AEC [1963] 247 p refs Conf. held in Gatlinburg, Tenn., 30 Apr.-1 May 1963 Sponsored by Oak Ridge Natl. Lab.
(Contract W-7405-ENG-26)
(CONF-170) CFSTI: HC $2.50/MF $1.25

CONTENTS:

1. THE PURIFICATION OF BERYLLIUM METAL BY A DISTILLATION PROCESS E. W. Hooper and N. J. Keen p 1-5 (See N66-28527 16-06)

2. CHARACTERISTICS OF VACUUM-DISTILLED BERYLLIUM E. D. Levine, J. P. Pemsler, and S. H. Gelles (Kennecott Copper Corp.) p 6-28 (See N66-28528 16-17)

3. AGEING EFFECTS ON BERYLLIUM SINGLE CRYSTALS D. Beasley and A. Moore p 29-47 refs (See N66-28529 16-17)

4. BASAL PLANE FRACTURE OF BERYLLIUM SINGLE CRYSTALS M. Herman and G. E. Spangler p 48-68 refs (See N66-28530 16-17)

5. THE EFFECT OF ZONE REFINING ON THE PURITY AND MECHANICAL PROPERTIES OF BERYLLIUM SINGLE CRYSTALS D. F. Kaufman, E. D. Levine, J. J. Pickett, and L. R. Aronin (Nuclear Metals) p 69-89 (See N66-28531 16-17)

6. THE EFFECT OF PURIFICATION AND RECONTAMINATION ON (0001) AND (10$\bar{1}$0) SLIP IN BERYLLIUM SINGLE CRYSTALS C. E. R. Tristem and A. Moore p 90-101 refs (See N66-28532 16-17)

7. AN ACCOUNT OF DEFORMATION AND FRACTURE IN SINGLE AND POLYCRYSTALLINE BERYLLIUM BETWEEN 20° AND 450°C A. Moore and G. C. Ellis p 102-120 refs (See N66-28533 16-17)

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13. A STATUS REPORT ON PURIFICATION OF BERYLLIUM AND ITS PROPERTIES R. F. Benshah (Calif. Univ.) p 214–220 refs (See N66-28539 16-17)

14. THE STRUCTURAL APPLICATION OF BERYLLIUM IN THE U. K. J. M. Worker, A. Moore, and G. C. Ellis p 221–244 (See N66-28540 16-17)

N66-28528# Kennecott Copper Corp., Lexington, Mass. Ledgemont Lab.

CHARACTERISTICS OF VACUUM-DISTILLED BERYLLIUM

E. D. Levine, J. P. Pemsler, and S. H. Gelles *In* Oak Ridge Natl. Lab. Conf. on the Phys. Met. of Beryllium [1963] p 6–28 (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

In the present study the distribution of residual impurities in distilled beryllium was studied in detail, and fabrication procedures were developed that resulted in the preparation of samples having a fine, uniform, recrystallized grain structure. These procedures involved attritioning to powder and extruding into flats. Impurity studies revealed that in addition to trace amounts of soluble impurities, insoluble particles containing iron and silicon exist; and that these particles probably limit ductility severely. A reduction in both soluble and insoluble impurities was obtained by performing a second distillation. Mechanical property studies revealed that double-distilled beryllium exhibits considerably greater three-dimensional ductility than material of lower purity. In wide-sheet bend tests, bend angles at fracture of 50° to 70° were observed. Author

N66-28529# Oak Ridge National Lab., Tenn.

AGEING EFFECTS ON BERYLLIUM SINGLE CRYSTALS

D. Beasley and A. Moore *In its* Conf. on the Phys. Met. of Beryllium [1963] p 29–47 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

A study was made of the effect of thermal treatment on both the flow stress and the occurrence of yield point phenomena of single crystals of Be. Vacuum-case-and-extruded electrolytic flake metal of two grades, commercial Pechiney and S. R. Pechiney were refined by a vertical floating zone technique using between 1 and 6 passes. Crystals in the solutionized condition, i.e., 2 hrs at 800°C and oil quenched relative to the precipitation ageing process, were subsequently aged between 200° and 550°C. Over the range 350° to 550°C a progressive increase in flow stress was observed reaching a maximum after times of ~150 and 1/2 hrs respectively, and followed by a decrease. At 200° and 300°C the change in flow stress was erratic. After a total of 5 passes the effect was present at 350°C, but undetectable at 450°C. No such changes were detected in crystals initially conditioned by an oversgeing treatment of 500 hrs at 575°C and oil quenched, although a marked decrease (55%) in flow stress at 450°C relative to that of the solutionized condition was observed. Derivations of the activation energy for these low temperature ageing processes suggest that the reaction is two stage each associated with 16 and 48 kcals/g-mole, respectively. It is argued that an interstitial atom, possibly C, is associated with the initial part of the ageing process and subsequently a substitutional atom becomes involved; it may be that an interstitial impurity precipitates and forms a nucleus for a substitution impurity which was previously considered not too nucleate below 575°C. The present differences in flow stress between single crystals initially solutionized and overaged at temperatures ~575°C are in marked contrast to corresponding behavior in polycrystalline material where differences ~10% were observed. Strain ageing effects were observed in crystals tested in the solutionized condition over the range 300° to 390°C. The activation energy for yield point return was calculated to be ~19 kcals/g-mole, whereas yield point loss in the range 450° to 540°C was related to dislocation locking by an interstitial impurity, possibly C, and subsequent coalescence as a precipitate within the matrix. This latter observation was supported, though not proved conclusively by low angle X-ray diffraction studies. Author (NSA)

N66-28530# Oak Ridge National Lab., Tenn.

BASAL PLANE FRACTURE OF BERYLLIUM SINGLE CRYSTALS

M. Herman and G. E. Spangler *In its* Conf. on the Phys. Met. of Beryllium [1963] p 48–68 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Single crystals of beryllium prepared by zone melting were tensile tested at room temperature with orientations such that basal glide was the principal deformation system. Fracture occurred in most cases by cleavage on the basal plane where the extent of deformation prior to fracture was enhanced by the effect of purification. This improvement in ductility resulted from lowering the critical resolved shear stress and the work hardening characteristics and minimizing crack nucleating precipitates. The results were analyzed with respect to two theoretical treatments for the propagation of cleavage cracks in metals which can glide and cleave on the same crystallographic plane. The first considers the conditions for propagating a crack nucleated by the splitting of a wall of dislocations while the second considers the case where a dislocation pile-up is responsible for the crack. Both schemes evolve similar stress relations but differ in the dependence of fracture on crystal orientation. The results of the analysis indicate that the cleavage of beryllium on the basal plane during tensile testing is associated with the split bend plane mechanism of crack initiation and propagation. Author (NSA)

N66-28531# Nuclear Metals, Inc., Concord, Mass.

THE EFFECT OF ZONE REFINING ON THE PURITY AND MECHANICAL PROPERTIES OF BERYLLIUM SINGLE CRYSTALS

D. F. Kaufman, E. D. Levine, J. J. Pickett, and L. R. Aronin *In* Oak Ridge Natl. Lab. Conf. on the Phys. Met. of Beryllium [1963] p 69–89 (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

The vertical floating zone technique was used in this investigation and descriptions of the apparatus and experimental procedures are provided. Chemical analysis and resistance ratio measurements showed that zone refining of beryllium results in large reductions in impurity content. Critical resolved shear stresses for basal and prismatic slip were found to decrease in a regular manner, with decreasing impurity content as measured by resistance ratio. It is also reported that the critical resolved shear stress for prism slip is strongly temperature dependent, and purification by zone refining increases the capacity for basal glide and reduces the rate of work hardening. The results additionally showed that brittle fracture by cleavage accompanying slip on a single set of prismatic planes is eliminated in crystals purified by zone refining. Charts and graphs which summarize the data obtained from this investigation are included. H.S.W.

N66-28532# Oak Ridge National Lab., Tenn.

THE EFFECT OF PURIFICATION AND RECONTAMINATION ON (0001) AND (10$\bar{1}$0) SLIP IN BERYLLIUM SINGLE CRYSTALS

C. E. R. Tristem and A. Moore *In its* Conf. on the Phys. Met. of Beryllium [1963] p 90–101 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Beryllium single crystals of greater than 99.95% purity were used for the determination of critical resolved shear stress of both (0001) and (10$\bar{1}$0) slip from 20° to 600°C. Compared with corresponding work on crystals of about 99.85% purity there was a decrease at 20°C from about 2000 to 400 psi in (0001) slip and a proportionally much smaller decrease in (10$\bar{1}$0) slip, from 11,000 to 7000 psi. At higher temperatures both these decreases are less marked. All tests were carried out on single crystals, oriented for slip on a single system, and grown from the melt using a vertical floating zone technique in an atmosphere of Ar 99.995% pure. Up to six zone passes were carried out; and preliminary analysis indicates that C, about 100 ppm, is the main impurity remaining after zone refining. Evidence was obtained that implies that the ultra-pure Be, obtained by zone refining metal of base purity 99.95% six times, may be readily contaminated by annealing in a dynamic vacuum (5×10^{-5} cm of Hg) at 1000°C for 18 hrs in such a way that the critical resolved shear stress at 20°C for (0001) slip increases from 400 to 1200 psi. Up to about 1/3 of this increase can be attributed to an oxide coating; and it is concluded that an impurity from the dynamic vacuum, possibly C, diffuses into the Be crystal. It was not determined to what extent contamination of the crystal affects prismatic slip. Purification, however, clearly facilitates slip, but to evaluate the effect, recontamination during testing and annealing must be prevented. Author (NSA)

N66-28533# Oak Ridge National Lab., Tenn.

AN ACCOUNT OF DEFORMATION AND FRACTURE IN SINGLE AND POLYCRYSTALLINE BERYLLIUM BETWEEN 20° AND 450°C

A. Moore and G. C. Ellis *In its* Conf. on the Phys. Met. of Beryllium [1963] p 102–120 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Compression tests were made at 165° to 280°C on single crystals (99.85%) oriented such that the resolved shear component in (hko) was zero. Between 280° and 195°C these crystals appeared to slip on (10$\bar{1}$1) and assuming slip occurred in the closest packed direction, (1123), the critical resolved shear stress for slip, neglecting friction, is ~42,000 psi. This resolved shear stress is high and comparable with the cohesive strength of polycrystalline Be. Pyramidal slip was not observed below 195°C, but strains ~3% were accommodated by twinning on (10$\bar{1}$2) and basal slip within the twinned regions. The appearance of (10$\bar{1}$2) twins in crystals compressed in the c-direction is not expected for this requires extension in the c-direction. However, Be can deform in three directions mutually at right angles above 195°C, but slip appears to be restricted to ⟨hko⟩ directions below 195°C. This restriction is believed to be the basis of the ductile-brittle transition that occurs in the region 150° to 200°C. These general conclusions were supported in studies using polycrystalline Be tested in tension at 150°C and examined both metallographically and by Laue asterism. The studies showed that although prolific (0001) and (10$\bar{1}$0) slip occurs in ⟨1120⟩, slip on (10$\bar{1}$1) also occurs in an unknown direction out of the basal plane. Although this latter work requires confirmation, it is believed that slip on (10$\bar{1}$1) in ⟨hkl⟩ occurs to relieve strains induced in neighboring grains by slip in ⟨1120⟩ and on (0001) and (10$\bar{1}$0). NSA

N66-28534# Lockheed Missiles and Space Co., Palo Alto, Calif.

DISCUSSION OF "AN ACCOUNT OF DEFORMATION AND FRACTURE IN SINGLE AND POLYCRYSTALLINE BERYLLIUM BETWEEN 20° AND 450°C BY A. MOORE AND G. C. ELLIS

Martin I. Jacobson *In* Oak Ridge Natl. Lab. Conf. on the Phys. Met. of Beryllium [1963] p 121–125 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Samples were cut from extruded rods with the specimen axes either parallel or at 45° to the extrusion direction. This produced samples favorably oriented for duplex prismatic slip and for basal slip, respectively. The duplex prismatic slip specimens exhibited an increase in tensile strength, a decrease in yield strength, and an increase in elongation as the temperature was varied from −200 to 100°C. The basal slip specimens showed a decrease in tensile strength, a lesser decrease in the yield strength, and a less rapid rate of decrease in elongation than the duplex prismatic slip specimens. At certain temperatures the ductilities of the basal slip specimens were greater than the duplex prismatic slip specimens. The relation between the strengths and ductilities of the two types of specimens is explained on the basis of twinning. NSA

N66-28535# Oak Ridge National Lab., Tenn.

BURGER'S VECTORS IN BERYLLIUM AND THEIR EFFECT ON DUCTILITY

G. P. Walters, C. M. Van Der Walt, and M. J. Makin *In its* Conf. on the Phys. Met. of Beryllium [1963] p 126–137 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Thin film electron microscope and selected area diffraction techniques were used to determine the possible Burger's vectors in Be. Dislocation loops and dislocations having various vectors were observed and likely slip directions determined. Slip in directions out of the basal plane was observed at room temperature in thin foils. These slip directions may not operate in bulk material at room temperature if the critical resolved shear stress is high. Twinning may be the more favorable deformation mode. However, if the critical resolved shear stress for slip out of the basal plane is lowered by purification, then the slip modes observed in thin foil experiments might operate in bulk material at room temperature. Author (NSA)

N66-28536# Oak Ridge National Lab., Tenn.
EFFECTS OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF HOT PRESSED AND EXTRUDED BERYLLIUM
G. P. Walters *In its* Conf. on the Phys. Met. of Beryllium [1963] p 138–159 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Hot pressed and extruded Pechiney and Brush beryllium have been examined after irradiation at 100°C, 350°C and 600°C at doses up to 6×10^{20} n/cm^2. No volume increases occured during irradiation, this is consistent with previous irradiations. Tensile tests were carried out at 20°C, 150°C, 350°C, 450° C and 600°C. There has been an increase in yield stress and a decrease in elongation during irradiation at 100°C and 350°C. No changes in specimens irradiated at 600°C occurred. The yield stress dose dependence and thermal recovery is discussed in terms of thin film microstructure. Irradiated yield stress values can be calculated approximately if the helium bubble configuration in the grains is known. Author

N66-28537# Oak Ridge National Lab., Tenn.
THE RECRYSTALLISATION CHARACTERISTICS OF WROUGHT INGOT BERYLLIUM SHEET
D. A. Cheer and J. N. Lowe *In its* Conf. on the Phys. Met. of Beryllium [1963] p 160–183 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Extrapolation of previous results showed that reducing the grain size to approximately 10 μ would produce a decrease in the ductile to brittle transition temperature to room temperature. The complete range of subrecrystallization working temperatures and subsequent annealing treatments were covered systematically in an attempt to produce fine grained Be sheet. The grain size of wrought sheet could not be reduced below 30 μ by conventional warm working and recrystallization techniques. The limiting factor was the inability to produce homogeneous nucleation due to heterogeneous deformation resulting from the limited number of available slip systems. Recovery processes precede recrystallization and although connected with the kinetics of recrystallization, do not affect the final grain size. NSA

N66-28538# Kennecott Copper Corp., Lexington, Mass. Ledgemont Lab.
THE AIR FORCE SPONSORED BERYLLIUM RESEARCH AND DEVELOPMENT PROGRAM
S. H. Gelles *In* Oak Ridge Natl. Lab. Conf. on the Phys. Met. of Beryllium [1963] p 184–213 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25
(Contract AF 33(616)-7065)

A research and development program aimed at making Be more useful as an Air Force structural material is described. Three approaches were used: to improve the inherent mechanical properties of the metal by purification, to alter the properties by changing structural parameters such as grain size and the preferred orientation, and to increase the technology and understanding of commercial Be. In the field of purification, research is described on the preparation of pure Be by the decomposition of beryllium iodide and on the preparation and evaluation of high purity Be produced by distillation alone and by a combination of distillation and zone refining. In addition, other efforts designed at understanding the role of impurities in Be are treated. These include a study of aging and strain aging behavior of commercially pure Be, a study of the flow and fracture characteristics as a function of grain size, purity level, and heat treatment, a study of the dislocation structure, of recrystallization and grain growth, and of impurities and precipitates. In addition, a limited study of the basal slip characteristics of high purity Be single crystals grown from the melt is described. The programs aimed at altering the properties and increasing the technology of commercially pure Be include studies of joining by TIG welding, resistance welding, furnace brazing, and ultrasonic welding; a program on the effect of low temperature, low reduction rolling on the mechanical properties of Be and Be alloy sheet; and a program dealing with surface damage in Be. Recommendations for further work in Be research and development are made. Author (NSA)

N66-28539# California Univ., Livermore. Lawrence Radiation Lab.
PURIFICATION OF BERYLLIUM AND ITS PROPERTIES Status Report, Period Ending May 1963
R. F. Bunshah *In* Oak Ridge Natl. Lab. Conf. on the Phys. Met. of Beryllium [1963] p 214–220 refs (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

Purification of Be was accomplished by crucible-free vacuum melting and distillation. The distillate is collected in the form of a sheet, which is then mechanically worked. The results of a limited number of bend tests on foil and sheet shows improved bend ductility over commercial material. At this stage it is not possible to state whether this improvement is a result of higher purity and/or less pronounced basal texture as compared to commercial material. Author (NSA)

N66-28540# Oak Ridge National Lab., Tenn.
THE STRUCTURAL APPLICATION OF BERYLLIUM IN THE U.K.
J. M. Worker, A. Moore, and G. C. Ellis *In its* Conf. on the Phys. Met. of Beryllium [1963] p 221–244 (See N66-28526 16-17) CFSTI: HC $2.50/MF $1.25

The purity, texture, strength, grain size, and formability of both powder and ingot Be were measured and structural applications most beneficial to each form were suggested. The high rigidity of Be provided care is exercised to minimize machining and fitting damage, can be exploited for specialized structural aircraft components. Ductile crack propagation is possible in cross rolled ingot sheet and is comparable to Mg alloy sheet used structurally in aircraft. The material damping of Be is comparable to Al, but this is of no consequence as the required damping in a structure can be obtained from carefully designed joints. Dimensional stability involves the usual factors that effect internal stress and also the study of low temperature ageing. An incomplete survey of mechanical properties showed a fatigue limit at room temperatures of >85% UTS in mean stress P, ±0.9P range loading cycle. This could be associated with limited slip modes below the brittle-ductile temperature, but it is anticipated that in the ductile temperature region conventional fatigue limits of 55% UTS are expected. NSA

N66-28584*# National Aeronautics and Space Administration. Washington, D. C.
OXIDATION PROTECTION OF NIOBIUM BY A $NbSi_2$ LAYER, IMPREGNATED WITH SnAl
B. Lux, P. Stecher, and N. Perlhefter May 1966 27 p Transl. into ENGLISH of the paper "Protection Contre l'Oxydation du Niobium au Moyen d'une Couche de $NbSi_2$ Impregnee de SnAl" Presented at the CNES Inter. Conf., Paris, 7–12 Feb. 1966
(NASA-TT-F-10183) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Protective oxidation resistant coatings on pure niobium, as used in aircraft parts, by a $NbSi_2$ layer impregnated with SnAl are described by several diagrams and photomicrographs. The protective effect of the "cladding" is primarily due to the tin–aluminum phase, rich in tin, distributed within the silicide, which acts as a barrier for the oxygen by forming an Al_2O_3 film at the surface of the coating. Manufacture of the coatings, by reaction with niobium in a tin–aluminum–silicon bath, is described. The highly mobile phase incorporated in a porous matrix, which latter acts as carrier for the liquid phase, forms a barrier for diffusion of the liquid phase and permits self-healing of minor surface flaws. Author

N66-28679# General Electric Co., Schenectady, N. Y. Research and Development Center.
HOT CORROSION MECHANISM STUDIES Final Report
15 Feb. 1966 121 p refs
(Contract N600(81533)63219)
(AD-629598) CFSTI: HC $4.00/MF $0.75

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N66-28680# General Electric Co., Schenectady, N. Y.
THE ROLE OF SODIUM SULFATE IN THE ACCELERATED OXIDATION OF NICKEL
J. R. Gambino Jan. 1966 *In its* Hot Corrosion Mech. Studies 15 Feb. 1966 41 p refs (See N66-28679 16-17) CFSTI: HC $4.00/MF $0.75

Thermogravimetric monitor methods of high temperature nickel oxidation by sodium sulfate showed that nickel oxidized initially: (1) independent of sodium sulfate concentrations; (2) dependent upon oxygen pressure; (3) dependent upon temperature; and (4) dependent upon the moisture content of the oxygen environment. High initial nickel oxidation rates in the presence of small sodium sulfate amounts were somehwat delayed when oxide films formed on the nickel specimens prior to sulfidation attack; in all cases vigorous corrosion occurred eventually. Correlation between the amount of nickel oxidation and the amount of sodium sulfate indicated sulfur expenditure during oxidation. G.G.

N66-28681# General Electric Co., Schenectady, N. Y.
OBSERVATIONS ON THE HIGH-TEMPERATURE SULFUR–OXYGEN CORROSION OF NICKEL
A. U. Seybolt Jan. 1966 *In its* Hot Corrosion Mech. Studies 15 Feb. 1966 18 p refs (See N66-28679 16-17) CFSTI: HC $4.00/MF $0.75

Sodium sulfate corrosion of nickel and nickel alloys largely concentrated at the grain boundaries; at high temperatures and enough available sulfur concentrations molten nickel–nickel sulfide eutectic compositions developed. Gas turbine alloys containing chromium eroded by forming CrS as the principal sulfide; low melting Ni_3S_2–Ni eutectic or Co_4S_3–Co eutectic did not develop in larger quantities as long as unreacted chromium was present. G.G.

N66-28682# General Electric Co., Schenectady, N. Y.
THE BEHAVIOR OF COBALT IN HIGH-TEMPERATURE SULFUR–OXYGEN ENVIRONMENTS
A. Beltran and A. U. Seybolt Jan. 1966 *In its* Hot Corrosion Mech. Studies 15 Feb. 1966 11 p refs (See N66-28679 16-17) CFSTI: HC $4.00/MF $0.75

Exposure of cobalt and cobalt–chromium alloys to Na_2SO_4 under an oxidizing atmosphere showed a reduction of the salt followed by sulfide formation. Liquid Co–Co_4S_3 eutectic (above 877°C) formed in the case of pure cobalt, and CrS developed in the presence of chromium; the rapid corrosive attack of the metal structure occurred by oxidation of the sulfide. It was concluded that optimal amounts of chromium in commercial gas turbine cobalt-base alloys form an adherent Cr_2O_3 surface oxide and thus assist in blocking sulfur penetration; this method can also prevent formation of the liquid sulfide eutectic. G.T.

N66-28683# General Electric Co., Lynn, Mass.
HOT CORROSIVE BEHAVIOR OF NICKEL AND COBALT BINARY AND TERNARY ALLOYS
P. A. Bergman Jan. 1966 *In its* Hot Corrosive Mech. Studies 15 Feb. 1966 32 p ref (See N66-28679 16-17) CFSTI: HC $4.00/MF $0.75

Nickel and cobalt and their binary and ternary alloys were studied for their hot corrosion behavior by exposure to combustion products of sulfur enriched (1%) diesel fuel, and a high concentration of sea salt (200 ppm) for 100 hours at 1675°, 1750°, and 1900°F. Metallographic and X-ray diffraction analyses of the exposed specimens found chromium additions to nickel and cobalt beneficial. Cobalt and titanium in nickel alloys, and nickel and tantalum in cobalt alloys did not effect the corrosive process significantly. Tungsten, molybdenum, and aluminum in nickel alloys and tungsten and molybdenum in cobalt alloys increased sulfur corrosion effects under high temperature conditions. In general, cobalt alloys showed more sulfur attack resistance than nickel alloys; nickel, cobalt, and chromium-rich spinels proved as much corrosion protective as Cr_2O_3. G.G.

N66-28808# Hanford Atomic Products Operation, Richland, Wash.
PAPERS AND PROCEEDINGS OF THE MEETING ON APPLICATIONS OF X-RAY DIFFRACTION IN THE ATOMIC ENERGY FIELD
W. G. Jolley and W. I. Clark (Pacific Northwest Lab.) Oct. 1965 92 p refs Meeting held at Richland, Wash., 25–26 Feb. 1965
(Contract AT(45-1)-1350)
(RL-REA-2595; CONF-650210) CFSTI: HC $3.00/MF $0.75

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N66-28811# Oak Ridge National Lab., Tenn.

COMPARISON OF POLE FIGURE DATA OBTAINED BY X-RAY DIFFRACTION AND MICROHARDNESS MEASUREMENTS ON ZIRCALOY-2

P. L. Rittenhouse and M. L. Picklesimer *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 16–28 refs (See N66-28808 16-17)

The variation of Knoop microhardness measurements on selected planes as a function of indenter axis relative to crystallographic or fabrication directions was determined for four lots of polycrystalline Zircaloy-2 (on which both conventional and inverse pole figures had been determined) and seven Zircaloy-2 single crystals. Data from the single crystals were used to construct a polar coordinate hardness contour map. With use of an empirical relationship between the single crystal hardnesses and those of the polycrystalline material conventional pole figures that compare favorably with those determined by X-ray diffraction could be constructed. A quantitative relationship with inverse pole figure data was also obtained. Author

N66-28813# Hanford Atomic Products Operation, Richland, Wash.

DETERMINATION OF RESIDUAL STRESS IN URANIUM WITH AN X-RAY DIFFRACTOMETER

W. G. Jolley *In its* Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 43–50 refs (See N66-28808 16-17)

The technique and limitations of residual stress analysis with an X-ray diffractometer as applied to uranium are discussed. A review of the theory is presented, and the type of equipment and X-ray geometry are discussed. Preparation of the standard uranium plate and the procedure used to standardize the X-ray results are presented in detail. Data showing a linear plot of increasing deflections of a uranium plate versus change in the "d" spacing are given. Author (NSA)

N66-28814# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

LINE BROADENING IN IRRADIATED MOLYBDENUM

H. E. Kissinger *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 51–62 refs (See N66-28808 16-17)

Molybdenum samples irradiated to a sufficiently high exposure show a change in the damage accumulation mechanism. This change is accompanied by an increase in line breadth and a decrease in lattice parameter, while electron micrographs show a clumping of previously homogeneously distributed defects. The line broadening is analyzed in terms of crystallite size and distortion effects, and the results are correlated with other observations. Author (NSA)

N66-28815# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

PRECISE POLE FIGURE MEASUREMENTS ON ROLLED URANIUM SHEET

E. F. Sturcken *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 63–72 refs (See N66-28808 16-17)

(Contract AT(07-2)-1)

Relative diffraction intensities were measured for 25 poles, hkl, in each of 43 directions for rolled uranium sheet (88% RA, 550 to 650°C). The data gave excellent proof of the validity of the general tensor which was developed for predicting anisotropic physical properties that result from preferred grain orientation. The data were also used to construct 25 pole figures and 43 inverse pole figures which will (in turn) be used to test proposed mathematical methods for inversion of pole figures to inverse pole figures and vice versa. The data are exceptionally precise because the absorption factor was constant in the diffraction geometry employed, and because a large number of grains were scanned (3 $in.^2$ or about 10^7 grains) to assure high statistical precision. Author

N66-28926# Denver Research Inst., Colo.

PHASE EQUILIBRIA OF THE TANTALUM-RICH REGION OF THE TANTALUM–TUNGSTEN–HAFNIUM AND TANTALUM–TUNGSTEN–ZIRCONIUM SYSTEMS Final Report, 1 Sep. 1964–30 Nov. 1965

Donald T. Klodt and Albert S. Yamamoto 31 Dec. 1965 27 p refs

(Contract AT(11-1)-1092)

(DRI-1092-226) CFSTI: HC $2.00/MF $0.50

The solid-state phase equilibria in the Ta-rich regions of the Ta–W–Hf and Ta–W–Zr alloy systems were investigated at 1600° and 1100°C. Alloys included in the investigation were in the compositional range from 100% Ta up to a maximum of 25 wt % each of W and Hf or W and Zr. The extent of the terminal solid-solution region in each system was investigated for the two isothermal levels and data are presented as portions of isothermal sections. In the Ta–W–Zr system the maximum solid solubility of Zr and W are both less than 10 wt % in the terminal Ta-rich solid solution at 1600°C and less than 5 wt % at 1100°C. At compositions greater than these amounts a two-phase field of the solid-solution phase and beta-Zr phase exists. The solid solubility of the combined Hf and Ta additions in the Ta-rich solid solution is greater than 10 wt % at 1600°C. A two-phase field of the solid-solution phase plus a phase tentatively identified as W_2Hf exists at greater compositions of W and Hf. X-ray diffraction data for alloys annealed at 1600°C in both systems are presented. Author (NSA)

N66-28936# ACF Industries, Inc., Albuquerque, N. Mex.
CRYOGENIC AND ELEVATED TEMPERATURE PROPERTIES OF 7039 ALUMINUM PLATE AND WELDMENTS
J. J. Dillon and L. A. Wallace 8 Oct. 1965 45 p
(Contract AT(29-1)-1352)
(ACF-14) CFSTI: HC $2.00/MF $0.50

Design-type data for 7039 aluminum base-metal and weldments are reported. Thermal conductivity of 7039-T61 was determined in the temperature range of +400°F to −320°F. The longitudinal and transverse, notched and unnotched, tensile properties of 1/2 and 1-1/2 in. thick 7039-T61 base-metal were determined at −423, −320, −100, ambient, +200, +300, and +400°F. Similar mechanical properties were obtained for 1/2 and 1-1/2 in. thick weldments (using X5039 filler wire). Additional mechanical properties were obtained for filler alloys D1495 and D1707 from 1-1/2 in. thick 7039 weldments at temperatures of −423, −320, −100, ambient, and +200°F. All weldments were post-weld heat-treated to the T61 temper. Author (NSA)

N66-28939# Pratt and Whitney Aircraft, Middletown, Conn.
CORROSION STUDIES OF REFRACTORY METAL ALLOYS IN BOILING POTASSIUM AND LIQUID NaK
K. J. Kelly, S. S. Blecherman, and J. E. Hodel 22 Apr. 1965 22 p refs Presented at the AEC–NASA Liquid Metals Information Meeting, Oak Ridge, Tenn.
(Contract AT(30-1)-2789)
(CNLM-6246; CONF-650434-1) CFSTI: HC $1.00/MF $0.50

Compatibility evaluations were made in gravity-feed potassium loops at temperatures up to 2000°F on the following materials: Nb–1 Zr, PWC-533 (C–Mo–Nb–Ti–Zr), PWC-11 (C–Nb–Zr), Type 316 stainless steel, and Mo-TZM. The evaluations were based on weight changes, chemical analyses, metallographic examinations, and mechanical strengths. A study was also made of interactions of Nb–1 Zr specimens in a Type 316 stainless steel–eutectic NaK loop operated at 1250°F. NSA

N66-28940# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
PROPERTIES OF SOME REFRACTORY METALS. V: NUMERICAL METHODS FOR CREEP AND RUPTURE ANALYSES
J. B. Conway 31 Jan. 1966 277 p refs
(Contract AT(40-1)-2847)
(GEMP-397) CFSTI: HC $6.00/MF $1.50

The commonly employed equations used to express strain-time behavior are discussed. In addition to considering those equations applicable to the transient creep process, several expressions capable of representing combined first- and second-stage creep data are discussed. Special least squares techniques developed for calculating creep equation constants are described in detail and are applied to the analyses of various strain-time measurements. Also, numerical techniques employed in the correlation of steady-state creep rates are considered. And finally, the numerical methods more commonly employed for use in the analysis of rupture data are reviewed to the extent that the basic mathematical procedures are outlined. Author (NSA)

N66-28942# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
A PROGRAM OF BASIC RESEARCH ON MECHANICAL PROPERTIES OF REACTOR MATERIALS Annual Summary Report, 1 Nov. 1964–31 Oct. 1965
T. A. Trozera, J. C. Appel, and R. H. Chambers 22 Dec. 1965 68 p refs
(Contract AT(04-3)-167)
(GA-6721) CFSTI: HC $3.00/MF $0.75

Work was performed on resistivity and mechanical property measurements of bcc metals; several source materials of Mo were evaluated; and preliminary irradiations were performed on W single crystals. Emphasis was placed on obtaining good resistivity measurements by means of the potential-drop method. This method was chosen as the most suitable for evaluating the purity of the W crystals and for following the changes in a crystal during annealing after both cold work and neutron irradiation. Annealing methods were developed first on a cold-worked W single crystal and extended to include measurements performed on an irradiated W crystal. Measurements on the irradiated crystal called for the development of specialized equipment so that the work could be safely performed in the laboratory without undue complication. Isochronal annealing data were obtained on both an ~20% cold-worked W single crystal and a crystal irradiated with fast neutrons to a dose of $\sim 2\times10^{19}$ nvt. Several important experimental features discovered in the oscillating-stress amplitude-dependent internal friction and modulus of very high purity bcc transition metals were explained by the use of a very simple dislocation model. The model is based on the assumption of the existence of sizeable Peierls–Nabarro stresses and Peierls potentials, and the existence of significant dislocation–dislocation interactions, resulting in long-range stress fields and static hysteresis phenomena (frequency-independent internal friction). It was shown that the superposition of a static bias stress leads to useful observations concerning the nature of the model of oscillating-stress amplitude dependence. The long-range stress-center model for internal friction should represent the effect of sources of stress centers other than those due to dislocation–dislocation interaction; e.g., neutron irradiation zones should be revealed as a modification of the existing internal stress fields and thus should be measurable via amplitude dependence in high-purity crystals. It is very important to note, however, that only in very high purity crystals were the details of the internal stress contributions to the internal friction observable. NSA

N66-28947# ACF Industries, Inc., Albuquerque, N. Mex.
METALLURGICAL CHARACTERISTICS OF WELDMENTS IN 0.750-INCH-THICK 6061 ALUMINUM
A. J. Kish and R. B. Erickson 14 Aug. 1965 27 p refs
(Contract AT(29-1)-1352)
(ACF-11; ACF-412-253) CFSTI: HC $2.00/MF $0.50

Techniques and weld procedures were developed for producing acceptable weldments in 3/4 in. thick 6061 Al. Strength levels (crossweld) of 15 ksi yield and 27 ksi ultimate were typical in the as-welded condition (welded in T6 temper). Weld metal elongations as-deposited were typically 18% in 1 in. Aging of weldments for 4 hr at 350°F increased cross-weld strength and reduced weld-metal elongations 7 to 10%. NSA

N66-28948# Atomics International, Canoga Park, Calif.
THE METALLOGRAPHY OF ZIRCONIUM-BASE ALLOY HYDRIDES
J. W. Raymond and D. T. Shoop 5 Feb. 1965 9 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-10927) CFSTI: HC $1.00/MF $0.50

Techniques currently employed in the metallographic preparation of hydrides of zirconium and zirconium-base

alloys are presented. A complete tabulation of metallographic procedures applicable to these materials is included. Author (NSA)

N66-28949# Institutt for Atomenergi, Kjeller (Norway).
HIGH TEMPERATURE LOW CYCLE FATIGUE OF AN EXTRUDED ALUMINUM-SILICON-MAGNESIUM-NICKEL ALLOY
V. de L. Davies and K. Bakken Oct. 1965 16 p refs
(KR-99)

The strain fatigue properties of the LFA-3 aluminum alloy Al–12 Si–1 Ni–0.8 Mg (wt %) were investigated at 250, 300, and 350°C. The results, when plotted as log plastic strain range versus log number of cycles to failure, show good agreement with the general results reported in the literature. From the present data it may also be concluded that, in the frequency and temperature range investigated, there is no correlation between frequency and number of cycles to failure for this particular aluminum alloy. This means that for a given plastic strain amplitude (or range) there is a definite number of cycles to failure which, within scatter, is independent of frequency and temperature. The stress, however, is both frequency and temperature dependent. Author (NSA)

N66-28978# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
VARIATION IN SENSITIVITY TO IRRADIATION DAMAGE-PRESSURE VESSEL STEELS, PART III
E. T. Wessel, T. W. Eichelberger, and R. W. Armstrong 15 Jan. 1965 234 p refs
(Contract AT(11-1)-GEN-14; NObs-78844)
(WERL-8844-6) CFSTI: HC $6.00/MF $1.25

Work was conducted to determine the reasons for the differences in the amount of damage, denoted by the increase in transition temperature, resulting from neutron irradiation in various heats of A302B steel. The basic and theoretical factors determining the transition temperature were studied using a Cottrell-Petch type of analysis. The effects of chemistry, heat treatment, microstructure, prestraining, thermal aging, and strain aging were studied. Based on favorable Petch parameters, the quenched and tempered structures were superior to those obtained by slower cooling methods from the austenitizing temperatures. Author (NSA)

N66-28985# California Univ., Berkeley. Lawrence Radiation Lab.
VIEWPOINTS OF STABILITY OF METALLIC STRUCTURES
Leo Brewer Feb. 1966 45 p refs
(Contract W-7405-ENG-48)
(UCRL-16250) CFSTI: HC $2.00/MF $0.50

The bonding in transition metals is considered and a quantitative procedure developed for the calculation of thermodynamic stability as a function of structure. The values of the enthalpies of sublimation of the bcc and hcp transition metal phases are tabulated for consideration of the possibility of stabilization of unstable structures by high pressure and for other thermodynamic applications. Author (NSA)

N66-28987# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.
THE RELATIONSHIP OF NITROGEN CONTENT OF AUSTENITIC STAINLESS STEELS TO STRESS CORROSION
Quarterly Report No. 438-8, Oct. 1-Dec. 31, 1965
B. N. Ferry and J. F. Eckel Jan. 1965 17 p refs
(Contract AT(40-1)-3208)
(EURAEC-1579) CFSTI: HC $1.00/MF $0.50

A N_2 concentration range of 0.06 to 0.09 % was obtained in wires of type 304 stainless steel by nitriding in different ratios of H_2–NH_3 at 1000°F for 24 hr. Nitrides were not metallographically observed in any of the wires. A dilatometer specimen holder was built and calibrated. Author

N66-28990# Neratoom, N. V., The Hague (Netherlands).
STAINLESS STEEL CLADDING OF HEAVY GAGE STEELS
Quarterly Report No. 6, Oct. 1-Dec. 31, 1965
[1965] 5 p Transl. into ENGLISH from French Prepared in cooperation with Ghent Univ. and S. A. Soudmetal
(Contract EURATOM-008-63-12 TEEB)
(EURAEC-1557) CFSTI: HC $1.00/MF $0.50

The mineral composition of the welding flux was changed to give a more viscous slag that would solidify faster and possess a larger surface tension than the flux previously developed. The flux performed satisfactory on flat plates inclined at varying slopes in the direction of welding. The flux will be tested on rings during the next report period. NSA

N66-28991# Neratoom, N. V., The Hague (Netherlands).
STAINLESS STEEL CLADDING OF HEAVY GAGE STEEL
Quarterly Report No. 5, Jul. 1-Sep. 30, 1965
[1965] 5 p Transl. into ENGLISH from French Prepared in cooperation with Ghent Univ. and S. A. Soudmetal
(Contract EURATOM-008-63-12 TEEB)
(EURAEC-1556) CFSTI: HC $1.00/MF $0.50

An alloyed flux was developed that would give the low alloy steel base a composition comparable to AISI 308 stainless steel 1/16 inch below the surface of the superimposed AISI 304 stainless steel tape. The development tests were performed on flat plates. When the tests were performed on rings, the slag formed by the flux was too fluid and solidified too slowly to be able to support a large molten pool on the curved surface. The effects of the welding parameters on the structure of the deposit was also investigated. NSA

N66-28998# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SOME PROPERTIES OF U–1 WT. PERCENT Mo ALLOY AFTER THERMAL TREATMENT [NIEKTORE WLASNOSCI OBROBIONEGO CIEPLNIE STOPU U-Mo 1 PERCENT CIEZ]
A. Hofman May 1965 11 p refs In POLISH; ENGLISH summary
(INR-645/XIV/PS)

Influence of the thermal treatment on the structure and the mechanical properties of U–1 wt % Mo was investigated. The behavior of this alloy under thermal cycling was examined. The experiments showed that by using an appropriate thermal treatment the required structure $\alpha+\gamma$ of the alloy can be obtained. The additions of the Mo improved the mechanical properties and dimensional stability of the alloy under cycle temperature changes. Author (NSA)

N66-29010# Nuclear Metals, Inc., West Concord, Mass.
INVESTIGATION OF BERYLLIUM WINDOWS FROM CEA BUBBLE CHAMBER Final Report
J. L. Klein and J. J. Picket 31 Dec. 1965 248 p refs
(Contract AT(30-1)-3600)
(NYO-10742) CFSTI: HC $6.00/MF $1.25

A metallurgical investigation of the remains of two Be windows that failed during the accident at the CEA liquid-hydrogen bubble chamber was carried out. Included in the investigation were: a review and evaluation of the design and service conditions for the windows; a review and evaluation of the fabrication and machining procedures used to produce the windows; chemical and spectrographic analysis of the Be remains; detailed visual examination of non-fracture and fracture surfaces of the Be and of the steel cap screws; simulated fracture, impact, and staining tests; identification of the origin of each fragment by machine markings; confirmation of the identities by metallographic examination; reassembly of most of the fragments to the fractured flange sections; X-ray diffraction determination of preferred orientation; radiography; ultrasonic tests; a metallographic study of cleanliness, grain size, and surface damage; density determination; a literature review of the mechanical properties of Be at cryogenic temperatures; tensile tests at 20°C and 20°K; double shear tests at 20°C and 77°K; bend tests at 20°C; and a detailed stress analysis of the inner window. It is concluded that there is no basis for believing that either window was defective, although failure might not have occurred if the surface damage that unavoidably results from the machining of beryllium had been removed by etching; however, such an etching step was not the responsibility of the vendor, for it was not specified by the buyer. It is also concluded that the inner window failed first and that it failed because the biaxial stresses imposed on it by the structure to which it was mounted and by the liquid hydrogen exceeded the fracture strength of the Be at 27°K; the outer window was fractured by the impact of the shattered inner window and the stream of liquid hydrogen released by the failure of the inner window. Recommendations for prevention of the recurrence of such a failure are presented. Author (NSA)

N66-29029# European Atomic Energy Community, Brussels (Belgium). Metallurgy Dept.

TENSILE TESTS AT LOW TEMPERATURES ON SAP 4% [ESSAIS DE TRACTION A BASSES TEMPERATURES SUR SAP 4%]

D. J. Boerman Feb. 1966 14 p refs In FRENCH
(EUR-2648.f)

The application of a new cryostat, working with a gaseous phase in order to execute tensile tests between room temperature and −196°C, is described. As material SAP 4% was chosen. At the same time a new correction method was used so that the elastic modulus was obtained without using an extensometer. Author (NSA)

N66-29062# Cornell Univ., Ithaca, N. Y. Materials Science Center.

INTERNAL FRICTION AND ELECTRON MICROSCOPY STUDIES IN ALUMINUM

Ashok Frank Mayadas (Ph.D. Thesis) Feb. 1966 122 p refs
/ts Rept.-424
(Contract AT(30-1)-2471)
(NYO-2471-2) CFSTI: HC $4.00/MF $0.75

Internal friction measurements at 4 kc were made on aluminum single crystals, with four different orientations and deformed 0.05 to 7% by axial compression or tension or bending at room temperature as well as at 77°K. The change of the Bordoni peaks was studied as a function of orientation, amount, kind, and temperature of deformation and amplitude of vibration. Simultaneously the dislocation structures in these samples were studied by transmission electron microscopy and correlated with the internal friction data. Long straight dislocations having ⟨110⟩ Burgers vectors and lying along the ⟨110⟩ directions, a structure characteristic of first stage hardening, are associated with low, broad not fully developed peaks. Entangled dislocations and the pressure of hardening mechanisms in the lattice are related to the commonly encountered Bordoni peaks. The peaks are amplitude independent even when the driving amplitude is in the breakaway region. For small deformation the lower temperature Bordoni peak appears prominently only when the sample is deformed at 77°K in which case it appears to be a single relaxation peak, and the higher temperature peak is almost completely suppressed. These observations are not fully explained by any of the current theories of the Bordoni relaxation, although the Paré modification of the Seeger–Donth theory appears the most promising. Author (NSA)

N66-29054# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

FATIGUE CHARACTERISTICS OF Ni-Cr-Fe ALLOYS WITH EMPHASIS ON PRESSURE-VESSEL CLADDING

D. F. Mowbray, G. J. Sokol, and R. E. Savidge 1 Jul. 1965 88 p refs
(Contract W-31-109-ENG-52)
(KAPL-3108) CFSTI: HC $3.00/MF $0.75

An extensive fatigue-testing program was conducted to establish the fatigue characteristics of Ni–Cr–Fe alloys in various fabricated conditions, with special emphasis on cladding. Nineteen different materials were tested including Ni–Cr–Fe alloy in the clad, wrought, and cast form, and nuclear pressure vessel steel. Characteristic fatigue curves were established for each material at room temperature with zero mean strain superimposed. Less extensive investigations of the effects of elevated temperature, superimposed mean stress, and specimen size on the fatigue strength of Ni–Cr–Fe alloy, were included. The numerous tests conducted on Ni–Cr–Fe alloy cladding provided a good indication of variability in cladding fatigue strength due to variation in composition and welding practice. The tests conducted on other materials provided a basis for comparing the fatigue strengths of Ni–Cr–Fe alloy in its various fabricated conditions, and for comparing cladding fatigue strength with that of pressure vessel steel, for which cladding provides corrosion protection. Information on processing, mechanical properties, microstructure, and inspection results for each of the materials tested is appended. Author (NSA)

N66-29064# Carnegie Inst. of Tech., Pittsburgh, Pa. Metals Research Lab.

A STUDY OF THE INTERACTION BETWEEN POINT DEFECTS AND DISLOCATIONS THROUGH DISLOCATION DAMPING EXPERIMENTS Annual Progress Report

1 Feb. 1966 21 p refs
(Contract AT(30-1)-3001)
(NYO-3001-1) CFSTI: HC $1.00/MF $0.50

Progress in studies on statistical thermodynamics of defect interactions, dislocation damping in dilute copper alloys, diffusion-controlled dislocation damping, thermally activated dislocation motion, dislocation damping in Type II superconductors (Nb), and dislocation pinning by ultraviolet light is reported. NSA

N66-29065# Brown Univ., Providence, R. I. Div. of Engineering.
SOME ASPECTS OF THE FRACTURE OF METALLIC COMPOSITES Technical Report No. 18
J. Gurland Feb. 1966 25 p refs Presented at the 4th Symp. of Fundamental Phenomena in the Mater. Sci., Boston, 31 Jan. 1966
(Contract AT(30-1)-2394)
(NYO-2394-18; CONF-660102-1) CFSTI: HC $1.00/MF $0.50

The fracture initiation and modes of failure of composites consisting of a brittle phase embedded in a ductile matrix are discussed. Factors contributing to crack initiation at reinforcing particles are residual stresses of thermal origin, elastic stress concentration, and plastic deformation. The fracture ductility of a particle-strengthened ductile metal is related to the particle concentration. Finally, the relative strengths of a brittle phase in bulk, as a bundle of fibers, and as embedded particles and fibers, are compared on the basis of statistical models of the state of aggregation and fracture mode. Author (NSA)

N66-29081*# General Dynamics/Convair, San Diego, Calif.
S-N CHARACTERISTICS OF NOTCHED SPECIMENS Final Report
Clarence R. Smith 15 Jun. 1966 45 p refs
(Contract NAS3-7268)
(NASA-CR-54503) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Fatigue test data and analyses are presented indicating that the results of a single fatigue test in the short life range plus mechanical properties of the material are all that is needed to predict S-N characteristics of notched specimens for tension–tension loading. Independent of nominal stress or stress concentration, the method is applicable to structural parts where neither average stresses nor stress concentrations are known. While confirmed by tests on 7075-T6 aluminum alloy only, the method should be applicable to most alloys having a low sensitivity to strain hardening or softening. Author

N66-29093# IIT Research Inst., Chicago, Ill. Metals Research Div.
YIELD POINT OCCURRENCE IN POLYCRYSTALLINE ALPHA-ZIRCONIUM
D. Weinstein [1965] 32 p refs Presented at 128th Meeting of the Electrochem. Soc., Buffalo, 10–14 Oct. 1965
(Contract AT(11-1)-578)
(CONF-651017-7) CFSTI: HC $2.00/MF $0.50

An abrupt yield point was found to exist during the tensile deformation of high-purity zirconium having grain diameters smaller than 0.0065 mm. Yield point occurrence was favored by air cooling from the recrystallization temperature as compared to water quenching. Specimens cut transverse to the rolling direction showed greater yield drops, and the discontinuity persisted to larger grain sizes. Existence of a yield point was favored at temperatures above −22°C, and disappearance of abrupt yield was noted at lower temperatures. It is shown that a Cottrell pinning/subsequent-unpinning mechanism does not account for the results; other mechanisms proposed for yield point occurrence in zirconium were examined in the light of these data. On the basis of supplementary microstraining experiments and in consideration of other known deformation characteristics of zirconium, the occurrence of a yield point is best explained by the dynamic dislocation model for yielding in body-centered cubic materials. Author (NSA)

N66-29097# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
SOME EFFECTS OF PRESTRAIN AT 77°K ON THE MECHANICAL PROPERTIES OF ZIRCONIUM AT ROOM TEMPERATURE
R. E. Reed-Hill and E. P. Dahlberg Oct. 1965 27 p refs Presented at the 128th Meeting of the Electrochem. Soc., Buffalo, 10–14 Oct. 1965
(Contract AT(40-1)-3262)
(CONF-651017-13) CFSTI: HC $2.00/MF $0.50

The effects of twinning on the ductility of zirconium at room temperature and deformation at 77°K are discussed. Newly discovered effects of twinning by prestrain at 77°K on the mechanical properties of Zr at room temperature are reported and discussed. NSA

N66-29124# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
A RESEARCH PROGRAM ON THE EFFECT OF SUBSTRUCTURE ON THE IRRADIATION STABILITY OF ASTM A302 GRADE B STEEL Quarterly Progress Report No. 3
T. A. Trozera and P. W. Flynn 24 Jan. 1966 13 p refs
(Contract AT(04-3)-167)
(GA-6923; EURAEC-1586) CFSTI: HC $1.00/MF $0.50

Several specimens that received cold work and heat treatments in the region expected to result in optimum properties were tested. Tubular specimen fabrication and gauging problems appear to be solved. The radial strain extensometer was scaled up for use on tubes to be tested under biaxial stresses. Irradiation capsules were designed and component fabrication was started. Author (NSA)

N66-29157# Rock Island Arsenal Lab., Ill.
GALVANIC SERIES OF METALS AS RELATED TO CORROSION
Ervin C. Tinsley Feb. 1966 22 p refs
(RIA-66-469; AD-631962) CFSTI: HC $1.00/MF $0.50

A revised electromotive series has been prepared for use by design engineers. Tables were prepared from experimental data and from available literature references. The experimental work indicated many variables were present in the half-cell potential measurement procedure. Many factors that could have caused deviations in results are discussed. This work provides information as to the location of various alloys previously not included in the electromotive series. The use of the improved table will be of value to the designer for his selection of compatible materials, and enable him to hold the possibilities of galvanic corrosion to a minimum. Author (TAB)

N66-29204# Southwest Research Inst., San Antonio, Tex. Dept. of Instrumentation Research.
NONDESTRUCTIVE EVALUATION OF METAL FATIGUE Scientific Report, 1965–1966
Felix N. Kusenberger, Byron E. Leonard, Richard L. Pesley, John R. Barton, and W. Lyle Donaldson Mar. 1966 92 p refs *Its* Rept.-15-1688-1
(Contract AF 49(638)-1502)
(AFOSR-66-0648; AD-631679) CFSTI: HC $3.00/MF $0.75

Studies were conducted to improve and evaluate existing ultrasonic Rayleigh wave and magnetic perturbation equipment for the detection of fatigue damage in aluminum and steel stress cycled specimens. Ultrasonic results obtained

from a 7075-T6 aluminum specimen stress cycled in direct uniaxial tension are presented; these include reproductions of Polaroid photographs of signal patterns and photomicrographs of the specimen surface showing the small fatigue crack detected. The recent results are compared with those of the previous program to indicate the improvement in resolution. On steel stress cycled specimens, both ultrasonic and magnetic technique results are presented including reproductions of typical data. These recent results are also compared with previous findings to establish the improvement in resolution. In addition, the fatigue detection results are compared with recent ones reported by other workers. Experimental investigations to determine the refraction properties of surface waves in laboratory size metallic specimens are described and the results discussed. These studies were conducted to obtain evidence that Rayleigh waves can be focused. Author (TAB)

N66-29213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESS-RUPTURE PROPERTIES OF TUNGSTEN WIRE FROM 1200° TO 2500°F
David L. Mc Daniels and Robert A. Signorelli Washington, NASA, Jul. 1966 22 p refs
(NASA-TN-D-3467) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The stress-rupture properties of 5-mil-diameter, type 218CS tungsten wire were determined for rupture times up to about 200 hours at test temperatures from 1200° to 2500°F. Results showed that the rupture properties were superior to those reported for other forms of tungsten, other refractory metals, and superalloys in this temperature range. The onset of primary recrystallization observed between 1800° and 2000°F was indicated by a decrease in microhardness, a decrease in ductility, and a coarsening of grain size. The strength superiority of the wire over the other materials was maintained beyond the onset of primary recrystallization. Author

N66-29220*# IIT Research Inst., Chicago, Ill.
GRAPHITE–METAL CARBIDE COMPOSITES
Y. Harada Washington, NASA, Jun. 1966 70 p refs
(Contract NASr-65(09))
(NASA-CR-507) CFSTI: HC $3.00/MF $0.75 CSCL 11D

Investigations have been conducted to determine the feasibility of fabricating metal–graphite composites by hot pressing at 2800°–3000°C. Mixtures of calcined petroleum coke with varying amounts of different metals (or their carbides) were used as the raw materials, and no binders were involved in this simple, one-step process. Ten metal additions were studied in this program: niobium, hafnium, molybdenum, tantalum, zirconium, titanium, boron, beryllium, uranium, and thorium. Evaluation of the resulting bodies included measurements of physical properties and examination of microstructure. The results show that strong, dense bodies can be realized by this method. Liquid phase sintering occurs through formation and diffusion of a carbide–carbon eutectic under the hot pressing conditions, and subsequent recrystallization of this phase yields strong bonding. The strongest bodies to emerge from these studies are in the Nb–C, Hf–C, and Mo–C systems. Author

N66-29312# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands). National Aerospace Lab.
THE RESIDUAL STRENGTH OF ALUMINIUM ALLOY SHEET SPECIMENS CONTAINING FATIGUE CRACKS OR SAW CUTS
D. Broek Mar. 1966 12 p refs Submitted for Publication Sponsored by the Netherlands Aircraft Develop. Board
(NLR-TR-M.2143) CFSTI: HC $1.00/MF $0.50

Specimens of 2024-T3 and 7075-T6 aluminium alloy sheet containing fine saw cuts appear to have the same residual strength as specimens with fatigue cracks of the same length. The stress level at which the fatigue cracks were grown does not affect the residual strength properties. Stop holes drilled at the crack tip postpone the onset of slow crack growth to a higher stress. If slow crack growth precedes fracture the residual strength is not affected by the acuteness of the initial crack, and there always is slow crack growth if the stress that initiates slow crack growth is not raised to or beyond the residual strength of a specimen with a fatigue crack of equal initial length. Author

N66-29313# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands). National Aerospace Lab.
THE RESIDUAL STRENGTH OF CRACKED SHEET—TESTS INTERRUPTED AFTER INTERMEDIATE SLOW CRACK GROWTH
D. Broek Jul. 1965 12 p Submitted for Publication Sponsored by the Netherlands Aircraft Develop. Board
(NLR-TR-M.2145) CFSTI: HC $1.00/MF $0.50

Residual strength tests were performed on 2024-T3 and 7075-T6 aluminium alloy sheet specimens of 600 mm width. After the cracks had shown some stable slow growth the specimens were unloaded and then reloaded. Unloading appeared to have no effect on the residual strength. Author

N66-29370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HARDNESS OF FIVE BORIDES AT 1625°C
W. A. Sanders and H. B. Probst 1 Sep. 1965 8 p refs Submitted for Publication
(NASA-TM-X-56851) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Borides of the transition metals, hafnium, zirconium, niobium, lanthanum, and holmium were tested for hardness at a temperature of 1625°C on commercial equipment. A 250 gram load and a dwell time of 15 secs were used. In addition, hardness tests were also conducted at room temperature using a standard microhardness tester with a diamond indenter and a load of 50 grams. A table of the materials tested, along with the hardness values obtained at both room temperature and at 1625°C, is given. Other information, such as the measured density, the theoretical density, grain size and metallography of the sample is also included in the table. Plots of the data depicting the hardness of the different borides as a function of temperature are presented. L

N66-29373*# General Dynamics Corp., San Diego, Calif. Johns Jay Hopkins Lab. for Pure and Applied Science.
VAPOR DEPOSITED TUNGSTEN FOR APPLICATION AS A THERMIONIC EMITTER MATERIAL
A. F. Weinberg, J. R. Lindgren, and R. G. Mills 28 Jun. 19[illegible] 15 p refs Presented at the Intern. Conf. on Thermionic Electrical Power Generation, London, 20–24 Sep. 1965
(Contract NAS3-6471)
(NASA-CR-67182; GA-6473) CFSTI: HC $1.00/MF $0.[illegible] CSCL 11F

Properties associated with the application of tungsten prepared by the hydrogen reduction of WF_6 as a thermionic emitter are discussed. Two major areas have been investigated: (1) the quality of material available from a va[illegible]

of sources, and (2) the resistance of this material to grain growth. Properties which have been determined during the evaluation program have been: (1) microstructure, both before and after extensive thermal treatments; (2) ductile-to-brittle transition temperature; (3) impurity content; and (4) hardness. Experimentation has shown that the resistance of vapor-deposited tungsten to grain growth is primarily structure sensitive, and in all cases where grain growth is observed, it starts at regions of marked grain misorientation, primarily a layer of small, equiaxed, randomly oriented grains which extends into deposited material up to 0.003 in. from the substrate surface. If this layer is removed prior to thermal treatment, resistance to grain growth is markedly improved.
Author

N66-29375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE SHEAR-BOND STRENGTH OF ALUMINA COATINGS
S. J. Grisaffe and Colin Baker (Case Inst. of Tech.) 19 Jul. 1965 13 p refs Submitted for Publication
(NASA-TM-X-56900) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Alumina coatings were plasma-sprayed onto AISI 304 stainless steel, and the resultant coating-substrate bond strengths were measured by a shear test. The effects of alumina powder particle size and purity, and substrate surface roughness on bond strength were determined. The bond strength data were analyzed using Weibull statistical methods. The bond strengths on polished surfaces were zero. Increased substrate surface roughness resulted in increased bond strengths. Increased alumina particle size uniformity and higher values of median particle size contributed to increased bond strengths and to more reproducible data, as indicated by higher Weibull slopes. Under fixed conditions of substrate roughness and alumina powder characteristics, the measured values of bond strength were found to decrease as the size of the coated substrate test area was made larger. This decrease was approximated by curves based on probability theory calculations.
Author

N66-29389*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
SOME HIGH TEMPERATURE DIFFUSION STUDIES ON MATERIALS OF THERMIONIC INTEREST
Ling Yang, R. G. Hudson, and F. D. Carpenter 28 Jun. 1965 15 p refs Presented at the Intern. Conf. on Thermionic Elec. Power Generation, London, 20-24 Sep. 1965
(Contract NAS3-6471)
(NASA-CR-64768; GA-6472) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Studies have been made on the diffusion between a number of uranium-containing materials and various refractory metals and alloys in the temperature range 1400-2000°C. Results are presented on the nature of interaction at the interfaces of these diffusion couples and the effect of composition, stoichiometry and temperature on the stability of vacuum electron emission properties of tungsten clad UO_2 and UC-ZrC.
Author

N66-29401*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SALT STRESS CORROSION OF Ti-8Al-1Mo-1V ALLOY SHEET AT ELEVATED TEMPERATURES
G. J. Heimerl, D. N. Braski, D. M. Royster, and H. B. Dexter [1965] 28 p refs Presented at the 5th Pacific Area Natl. Meeting of the Am. Soc. for Testing and Mater., Seattle, 31 Oct.-5 Nov. 1965 *Its* Paper No. 42
(NASA-TM-X-56881) CFSTI: HC $2.00/MF $0.50 CSCL 11F

In the investigation of the salt stress corrosion of Ti-8Al-1Mo-1V alloy sheet, many small self-stressed and residual stress specimens were salt coated, exposed up to 6400 hours at 400°F to 600°F (477°K to 589°K), and tested at room temperature to determine the extent of the stress corrosion cracking. Coatings of NaCl were more corrosive than $CaCl_2$, $MgCl_2$, or sea salt, and thin coatings were more damaging than thick. Environmental tests showed that a decrease in oxygen and air pressure reduced stress corrosion, but that the role of moisture and air velocity still remained in doubt. Stress corrosion cracks were intergranular, and a correlation was obtained between the results of the room-temperature corrosion tests and the crack penetration. $TiCl_2$ appeared to be one of the corrosion products. Surface treatments such as shot peening, nickel plating, vibratory cleaning, and polyimide coatings proved effective in preventing corrosion for exposures up to 2000 hours at 600°F.
Author

N66-29447*# AVCO Corp., Tulsa, Okla.
A STUDY OF THE BLISTERING OF METAL SURFACES BY SOLAR SYSTEM IONS First Quarterly Progress Report, Period Ending 14 Jul. 1965
J. A. Cooley Aug. 1965 10 p
(Contract NASw-1203)
(NASA-CR-67132; TR-65-363-11) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Single crystal samples of pure aluminum were irradiated in vacuum with 30, 50 and 70 keV protons at different total fluxes. The objective was to define optimum parameters for oxide film removal with no residual blistering of the surface. Results were not consistent, thus indicating probable variation of oxide layer thickness. Two pure polycrystalline gold samples were irradiated, one with 15 keV protons and one with 100 keV protons. No surface blistering was noted on these samples.
Author

N66-29488# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
THE COMPATIBILITY OF PuO_2 WITH TYPE 316L STAINLESS STEEL AT ELEVATED TEMPERATURE
R. Paris Mar. 1966 16 p refs
(AERE-R-5147)

PuO_2 pellets have been heated in contact with type 316L stainless steel for various times at temperatures between 1270°C and 1350°C. No reaction was observed at 1270°C but a zone appeared round the PuO_2 periphery at 1300°C and this increased in depth with time and temperature. Microprobe and X-ray examination showed that the reaction was probably due to reduction of the PuO_2 by the chromium in the steel.
Author

N66-29663# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
HIGH-TEMPERATURE CORROSION STUDIES. INFLUENCE OF YTTRIUM ON OXIDATION OF NICKEL AT 1200°C
Robert M. Doerr, James W. Jensen, and Charles C. Meyers 1966 28 p refs
(BM-RI-6800)

The oxidation kinetics of Ni–Y alloys in the range 0.04 to 8 weight-percent Y, and of high-purity Ni, were compared using a sensitive volumetric apparatus. The reactions followed approximately the parabolic rate law; for oxidations in O_2 at 0.5 atm and 1,200°C, the parabolic rate constant was about $0.37+(0.084)\ (Y-2.11)$ mg cm^{-2} $min^{-1/2}$, where Y represents the weight-percent Y in the alloy. Internal oxidation of Y occurred in the alloy specimens and the resultant Y_2O_3 particles served as markers showing that the subsequent oxidation of the surrounding Ni was by inward diffusion of O. The scale consisted in each case of NiO, but the inner parts of the scale on the alloy specimens included the patterned Y_2O_3 particles. The thicknesses of the inner parts of the scale depended directly on the Y concentration, and the thicknesses of the Y_2O_3-free outer parts of the scale were inversely related to the Y content of the alloys. There is thus a relation between the thickness of the outer part of the scale and the protectivity of the scale. Outward diffusion of Ni and inward movement of O, from the inner boundary of the Y_2O_3-free part of the scale, is proposed as a mechanism for these results. Author

N66-29579# National Lead Co. of Ohio, Cincinnati. Technical Div.

METALLOGRAPHY OF URANIUM: PROCEDURES AND STANDARDS

M. H. Cornett 25 Mar. 1966 87 p

(Contract AT(30-1)-1156)

(NLCO-964) CFSTI: HC $3.00/MF $0.75

Techniques for the preparation of uranium specimens so that their macro- and microstructures may be studied are presented. Included are procedures for sample preparation, etching, and photography. Also included are metallographic standards for the evaluation of the prepared samples with respect to grain size, recrystallization, and inclusion content. NSA

N66-29587# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROSLAG REMELTING DESERVES CONSTANT ATTENTION

4 Jan. 1966 7 p Transl. into ENGLISH from Metallurg. (Moscow), no. 8, 1964 p 21

(FTD-TT-65-1464/1+4; AD-627111) CFSTI: HC $1.00/MF $0.50

A brief resume is presented describing the activities of the All-Union Interfactory school on electroslag resmelting techniques and vacuum steel production. D.T.

N66-29606# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

THE LOW-TEMPERATURE ALLOTROPIC TRANSFORMATIONS IN PLUTONIUM

R. D. Nelson Apr. 1965 203 p refs

(Contract AT(45-1)-1830)

(BNWL-49) CFSTI: HC $6.00/MF $1.25

Transformation kinetics, phase transformation damage, steady-state creep, and effects of applied stress on phase transformations of Pu were investigated. These related phenomena are discussed and are correlated with similar information about more common metals. There are several characteristics of these phase changes that are consistent with either diffusional or martensitic transformations, but these data alone are insufficient to characterize them. Data for the $\beta \rightarrow \alpha$ and $\alpha \rightarrow \beta$ phase changes indicate martensitic transformations; data for the $\beta \rightarrow \gamma$ and $\gamma \rightarrow \beta$ phase changes are consistent with diffusional transformations.

Author (NSA)

N66-29609# IIT Research Inst., Chicago, Ill.

YIELD PHENOMENA AND FRACTURE OF HYDRIDED ZIRCONIUM Quarterly Report, 1 Oct.–31 Dec. 1965

D. Weinstein and I. Broverman 3 Feb. 1966 13 p refs

(Contract AT(11-1)-578)

(IITRI-578-P27-14; EURAEC-1576) CFSTI: HC $1.00/MF $0.50

Previous work showed that the yield point in fine-grained (0.0037-mm grain dia) Zr disappeared as the temperature was lowered from 23 to −196°C. The strain hardening coefficient concomitantly increased progressively. The yield point and strain hardening behavior were consistent with the model developed by Johnston and Hahn. The results suggest that a dynamic dislocation mechanism controlled the observed yield point phenomena. An attempt was made to reproduce and explain the reversal in the temperature dependence of yield point that Keeler found in relatively coarse-grained Zr. Following from the Johnston–Hahn model, it was logical to expect that such a reversal should be accompanied by a reversal of strain hardening coefficient, i.e., decreased strain hardening rate at lower temperatures (−196°C) at which a yield point appeared. For materials annealed so as to produce 0.005- and 0.009-mm grain sizes, no yield point reversal was observed. Since grain size is especially critical, another series of tests is proposed (based on 0.007-mm grain size) before a definite conclusion concerning yield point and strain hardening reversal can be reached. Author (NSA)

N66-29611# Los Alamos Scientific Lab., N. Mex.

GMX-2 SPALLING CALCULATIONS

Charles L. Mader Oct. 1965 31 p refs

(Contract W-7405-ENG-36)

(LA-DC-7692) CFSTI: HC $2.00/MF $0.50

The results of some numerical spalling studies on aluminum, copper, iron, and nickel are presented. The equations of state for spall pressures and volumes are briefly discussed. Also spall as a function of tension rate is discussed. NSA

N66-29687# Illinois Univ., Urbana. Dept. of Civil Engineering.

FATIGUE OF PLATES AND WELDMENTS IN HIGH STRENGTH STEELS Quarterly Report, 1 Dec. 1965–28 Feb. 1966

Mar. 1966 36 p refs

(Contract NObs-94232)

(AD-632004) CFSTI: HC $2.00/MF $0.50

Studies were made on the fatigue behavior of HY-100 weldments and weldments in HY-130/150 steel. The physical properties and chemical compositions of the base metals are presented. The fatigue data for both materials were obtained using axially loaded transverse butt-welded specimens in the as-welded condition. Details of the test specimens are given. The net width at the test section was determined by the test stress cycle and the capacity of the fatigue machines. A MIL-12018 electrode has been used for the HY-100 transverse butt-welded specimens currently under investigation. The fatigue tests were conducted on zero-to-tension stress cycles; the results are compared with

data from similar tests of the HY-100 material welded with a MIL-11018 electrode. Metallurgical examinations of HY-130/150 weldments prepared with each of two welding procedures were made; and the results are reported. Preliminary fatigue test data are reported for transverse butt-welded specimens using the two welding procedures. TAB

N66-29801# Titanium Metals Corp. of America, New York.
DEVELOPMENT OF A STABLE-BETA TITANIUM ALLOY Ninth Quarter Report, 1 Jul.-30 Sep. 1966
D. B. Hunter [1966] 46 p refs
(Contract DA-30-069-ORD-3743)
(WAL-TR-405/2-8; AD-619399) CFSTI: HC $2.00/MF $0.50

An X-ray examination of Ti-17V-10Cr-3Al-1Si revealed the presence of alpha and Ti_6Si_3 lines in a sample quenched from 2050°F and aged at 1250°F. No hardening response upon aging at 1250°F was found in Ti-17V-10Cr-3Al-2Ge. Room temperature tensile tests upon ageable beta alloy Ti-17V-2Fe-2Co-3Al indicated that a yield strength of 180,000 psi was reached after aging for 8 hours at 900°F; aging for 24 hours at 800°-900°F produced yield strengths exceeding 200,000 psi. Creep tests on Ti-8Mo-8V-2Fe3Al showed that, when aged at 900°F for 8 hours, after 500 hours exposure at 600°F, under a load of 128,000 psi, deformations did not exceed 0.43%. Ti-17V-4Fe-3Al, exposed under similar conditions, showed creep deformations of 2%. Oxidation and stress corrosion tests on the above alloys indicated that Ti-8Mo-8V-2Fe-3Al was the superior alloy. Weldability tests on ageable beta alloys suggested their performance was similar to the commercial alloy Ti-13V-11Cr-3Al, whereas the two stable-beta alloys Ti-17V-10Mn-3Al and Ti-8Mo-8V-6Fe-3Al had poor weldability relative to Ti-13V-11Cr-3Al. Tests on overaging ageable beta alloy Ti-17V-7.5Co-3Al showed that little increase in hardness over that of the solution treated condition occurred upon aging at 1100°F for up to 16 hours. Author (TAB)

N66-29814# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
EFFECT OF FLUID FLOW ON SOLIDIFICATION STRUCTURE
M. C. Flemings, H. P. Utech, and E. S. Mikach Mar. 1966 73 p refs
(Contract Nonr-3963(09))
(TR-1; AD-631928) CFSTI: HC $3.00/MF $0.75

Samples of tellurium-doped indium antimonide that exhibited solute banding when solidified in a horizontal boat under ordinary conditions showed no bands when solidified in the presence of a vertical dc magnetic field. In crystal growth of tin, as of indium antimonide, marked thermal fluctuations occur in the liquid during growth as a result of thermal convection. Effects are examined here of growth parameters on these fluctuations. A dilute aluminum-copper alloy that exhibited solute banding when solidified in a horizontal crystal growing boat showed no bands when solidified in the presence of the magnetic field. The morphology and kinetics of ice grown in supercooled water are markedly affected by convection of the water. Brief consideration is given the problem of analysis of effect of fluid flow on dendritic growth in undercooled melts, employing the idealized Fisher dendrite. The analysis is then extended to growth of dendrites in non-undercooled alloy melts and it is shown that similar effects are to be expected. TAB

N66-29851# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
STUDY OF THE EFFECT OF SOLIDIFICATION STRUCTURES ON THE STRENGTH OF METALS. Quarterly Progress Report
R. W. Kraft and R. W. Hertzberg 28 Apr. 1966 11 p
(Contract DA-36-038-AMC-2723(A))
(QPR-3; AD-632081) CFSTI: HC $1.00/MF $0.50

Progress on work associated with the mechanical working of Al-Al_3Ni eutectic alloy specimens consisted of: improvements made to the unidirectional solidification apparatus to produce more perfectly aligned specimens; the hydrostatic extrusion of specimens with a colony microstructure by various amounts up to 65% reduction in area in one operation; and a preliminary evaluation of the effect of strain hardening on the yield strength of as-cast material. In addition, it has been found that specimens with the colony microstructure could not be drawn at a reduction of 9%, although they could be extruded by reduction up to at least 65%. Work on the other phase of the research concerned with the mechanical properties of as-controlled magnesium base eutectics included: the construction of a new melting chamber to facilitate the production of master heats; experimentation with several heats of four different alloys; the unidirectional solidification of Mg-Cu and Mg-Ni specimens; and preliminary evaluation of the mechanical properties of one of the controlled eutectics (Viz., Mg-Mg_2Cu). Author (TAB)

N66-29866*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF ORIENTATION ON FRICTION CHARACTERISTICS OF SINGLE-CRYSTAL BERYLLIUM IN VACUUM (10^{-10} TORR)
Donald H. Buckley Washington, NASA, Jul. 1966 20 p refs
(NASA-TN-D-3485) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Studies were conducted to determine the influences of the crystallographic orientation of single-crystal beryllium on its friction characteristics when in sliding contact with sapphire and polycrystalline beryllium and aluminum oxide. Experiments were conducted in a vacuum of 10^{-10} torr with a 3/16-inch hemispherical-radius beryllium crystal sliding on a flat of beryllium and aluminum oxide. The rider was loaded against the flat with various loads from 100 to 1500 grams and the flat disk was rotated to give a sliding speed of 0.013 centimeter per second. The results of the investigation showed that the basal plane exhibited lower friction than the prismatic slip plane. With the basal plane parallel to the interface, lower friction coefficients were observed in the (1120) than in the (1010) directions. The lowest friction coefficient for basal orientation was obtained with the basal plane inclined 135° to the sliding interface. The friction coefficient of single-crystal beryllium sliding on sapphire was lower than that of single-crystal beryllium sliding on polycrystalline aluminum oxide. With sapphire, brittle fracture of sapphire was observed, while with polycrystalline aluminum oxide, shear of beryllium was observed. Author

N66-29871*# Aerojet-General Corp., Sacramento, Calif.
DEVELOPMENT AND EVALUATION OF BRAZE ALLOYS FOR VACUUM FURNACE BRAZING
K. L. Gustafson Washington, NASA, Jul. 1966 35 p /its Rept.-8800-26
(Contract NAS3-2555)
(NASA-CR-514) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A program was conducted to develop an alternative braze alloy for the copper-gold commercial alloy (Nicoro) widely

used to vacuum braze large rocket engine tubular thrust chambers. The use of this alloy on extremely large thrust chambers, such as the M-1 engine, would result in inordinate costs. Copper and 10 copper-base alloys were investigated; eight of these copper-base alloys were non-commercial alloys. Two of these alloys, AGC-200 and AGC-201, proved to be equal in all respects to the commercial alloy Nicoro. The remaining six of these new alloys contained small additions of silicon and were somwhat weaker than Nicoro because of the formation of brittle silicide phases. Two commercial copper-base alloys, Anaconda 656 and Anaconda 651, compared favorably with Nicoro; however, additional research is required to reduce their impurity content for statisfactory high temperature vacuum brazing operations. Use of AGC-200 or AGC-201 braze alloy in preference to Nicoro will reduce the gold content by 57% and offer a 50% reduction in braze material costs. Author

N66-29881# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

IMPROVEMENT OF A COMMERCIAL HYPEREUTECTIC ALUMINUM-SILICON MASTER ALLOY

Ronald R. Lowery, J. G. Croeni, and H. Kato 1966 33 p refs (BM-RI-6765)

Hypereutectic aluminum–silicon alloys were developed which had better mechanical properties than the unmodified hypereutectic alloy. A commercial aluminum-20 weight-percent silicon master alloy was selected as a binary base for improvement. The primary silicon grains were reduced from ASTM 4.5 to ASTM 8.5 by the use of phosphorus and phosphorus compounds. The remaining eutectic matrix was refined by sodium metal additions of 0.2 weight-percent. Solid solution strengthening of the alpha aluminum was obtained by adding 2 percent copper and 0.5 percent magnesium. Also, 1 percent nickel was added to harden the alloy. Optimum thermal treatment consisted of a solution treatment for 10 hours at 480°C with hot water quench, followed by aging for 6 hours at 175° C. The final alloy exhibited a Rockwell B hardness of 75 ±2 in the heat-treated condition. The ultimate tensile strength was 39,500 psi with no recordable elongation. The coefficient of linear thermal expansion was 20.4×10^{-6} per °C in the temperature range 20° to 300° C. No wear resistance data were collected. Author

N66-29891# Marine Engineering Lab., Annapolis, Md.

PROPERTIES OF THE WELD HEAT-AFFECTED ZONE IN HY-130/150 STEEL

P. W. Holsberg and W. G. Schreitz Apr. 1966 15 p refs (MEL-87/66; AD-632072) CFSTI: HC $1.00/MF $0.50

Properties of the weld heat-affected zone, including hot-cracking tendencies and effects of thermal cycling on strength and toughness, were determined for a 5Ni–Cr–Mo–V steel developed as an HY-130/150 hull plate alloy. The hot-cracking tendency of the alloy was low. The yield strength of the heat-affected zone was equivalent to that of the base metal. The Charpy V-notch impact strength of samples which had received double thermal cycles, simulating multipass weldments, was equivalent to that of the baseplate in both the as-welded and the stress-relieved conditions. These results, obtained by weld-simulation methods, were confirmed by impact tests of samples from the heat-affected zone of actual weldments. The impact strength of the as-deposited weld metal was low compared to the baseplate and was greatly reduced by stress–relief treatment.

Author (TAB)

N66-29900# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURAL DIAGRAM OF NIOBIUM–NICKEL SYSTEM

V. N. Svechnikov, V. M Pan, and V. G. Korobeynikova 30 Mar. 1966 18 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Inst. Metalofiz., Sb. Nauch. Rabot, no. 19, 1964 p 198-205

(FTD-TT-65-1489/1+2+4; AD-632071) CFSTI: HC $1.00/MF $0.50

A complete diagram of phase equilibriums of a niobium–nickel system was formulated. It was found that from the side of nickel rich alloys, the variant of the diagram, introduced by S. A. Pogodin and A. N. Zelikman, is confirmed. It was shown that in alloys of Nb–Ni system, four phases exist in solid phase: the alpha-solid solution of nickel and niobium (maximum solubility of about 4.5%, solubility at 1100° C—1.2% and at 800° C—0.6% Ni), alpha-solid solution of niobium in nickel (maximum solubility about 13.5%, solubility of 1100° C—about 12% Nb) delta-phase intermetallide Ni_3Nb with a melting point of 1430°C and a very narrow (less than 1%) area of homogeneity and eta phase—intermetallide NiNb with a wide area of homogeneity (6.4% at 800°; 8.4% at 1000° and 12.8% at 1170°C). It was established that phases existing in the alloys of the system form with liquid three triphase nonvariant equilibriums. Nickel additions, raising the hardness of niobium, do not improve the preservation of hardness at high temperature (800°–1000°C). Small (up to 4 weight %) additions of nickel considerably increase the hardness resistance of niobium (Bi—5-fold) when testing in air for a period of 5 hours at 1000°C. Author (TAB)

N66-29907*# Ipsen Industries, Inc., Rockford, Ill.

INVESTIGATION OF FOAMED METALS FOR LAUNCH AND SPACE VEHICLE APPLICATIONS

Edward R. Byrnes, Jr. and Charles J. Twine May 1966 131 p refs

(Contract NAS8-11048)

(NASA-CR-76061) CFSTI: HC $4.00/MF $1.00 CSCL 11F

Investigations of methods for manufacturing porous metals are reported. Effects of variables in processing and fabrication on the ultimate strength and integrity of foam metals are discussed. The foamed metals studied were aluminum, titanium, nickel, 316 stainless steel, H-11 tool steel, and molybdenum. No unusual difficulties were encountered in preparing foam metals of molybdenum, H-11 tool steel, 316 stainless steel and nickel; however, at densities less than 15% of theoretical, the foam metals exhibited brittle fracture characteristics. A useable foamed aluminum was not produced. Titanium could be foamed and sintered, but oxide contamination between the grain boundaries resulted in a product with marginal ductility for structural applications. Variable density beams were manufactured wherein the core material was of graduated density through the depth of the beam. The results of mechanical, physical, and thermal property tests are presented. Data concerning the machinability and fabrication techniques of foam metals are contained in the report. Author

N66-29936# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

ON THE THEORY OF INTERSTITIAL SOLUTIONS OF THE NOBLE METALS IN LEAD, TIN, THALLIUM, INDIUM, AND CADMIUM

Thomas R. Anthony and David Turnbull 14 Jan. 1966 10 p refs

(Contract ARPA SD-88)

(ARPA-23; AD-631856) CFSTI: HC $1.00/MF $0.50

The interstitial dissolution of the noble metals (Cu, Ag, and Au) in lead, tin, thallium, indium, and cadmium is explained by D-D correlations binding between the isoelectronic cores of the solute and solvent atoms. Author (TAB)

N66-29942# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.
APPLICATION OF THE METHOD OF COMPOSITION TO STRESS-RUPTURE DATA ON STEEL
James G. Faller Nov. 1965 14 p refs
(BRL-MR-1712; AD-631850) CFSTI: HC $1.00/MF $0.50

Data on the time taken for a metallic specimen to fail under a given stress and constant temperature has been fitted by a power law relation and the assumed correlation tested by linear regression analysis. Results show that the stress at which rupture occurs for a given temperature and time can be predicted with a high degree of confidence in this particular case. Author (TAB)

N66-29945# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
CHEMICAL MILLING OF ALLOY STEELS
Sara J. Ketcham 9 Mar. 1966 22 p refs
(NAEC-AML-2418; AD-631952) CFSTI: HC $1.00/MF $0.50

Experiments were conducted to determine the effect of chemical milling on susceptibility of high strength steels to hydrogen embrittlement and stress corrosion cracking. Alloys studied included H-11, 4340 and 17-7 PH. Results indicated that the acid baths used for chemical milling do initially embrittle these alloys, but recovery of ductility takes place at room temperature within one week if there is no barrier to the escape of hydrogen (such as a plating). A recovery treatment of 48 hours at room temperature followed by 4 hours at 375°F is recommended. A high strength steel with a chem-milled surface is more susceptible to stress corrosion cracking than one with a machine ground surface. Author (TAB)

N66-29978*# Syracuse Univ., Research Inst., N. Y. Dept. of Chemical Engineering and Metallurgy.
CREEP AT ELEVATED TEMPERATURES AND HIGH VACUUM Semiannual Report No. 4
K. Schroder, A. Giannuzzi, and G. Gorsha May 1966 26 p refs
(Grant NsG-619)
(NASA-CR-76088; SURI-MET-E-1189-566-SA) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A series of high purity copper wires were creep tested in a high vacuum at temperatures between 785° and 855°C. They were tested in both the argon bombarded, clean state, and after oxidizing in air at these elevated temperatures. It was found that the creep rate of the sample decreased noticeably after oxidation for about one hour between 400° and 500°C. The sample fractures in the oxidized state in tests above 835°C. The largest minimum creep rate of the argon bombarded, clean sample was about 0.1% per minute, whereas the largest minimum creep rate for the oxidized sample under the same stress of about 850 gr/cm^2 was less than 0.02% per minute. It is proposed that the creep phenomena can be explained with a model, in which oxide films act as dislocation barriers for dislocation. Further experiments are required to elucidate this mechanism and the fracture process. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-28480*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF THE GROWTH PARAMETERS INVOLVED IN SYNTHESIZING BORON CARBIDE FILAMENTS First Quarterly Report
A. Gatti, E. Feingold, and V. A. Cordus 20 May 1966 29 p refs
(Contract NASw-1383)
(NASA-CR-75715) CFSTI: HC $2.00/MF $0.50 CSCL 20B

Boron carbide whiskers grown in a chimney-type resistance furnace were found to be of the curved instead of the more desirable straight variety. A radial-type furnace was developed which provided a more uniform thermal gradient in the growth region and produced straight short whiskers which were not long enough for reinforcement. Efforts to overcome this length deficiency have not been successful. Studies were, therefore, continued with the chimney-type whisker growth, and a new geometry has increased B_4C whisker yield by a factor of ten. Annealing for five hours at 1900°C in vacuum has removed the curvature in these whiskers, and the annealed whiskers appear to have smoother surfaces. The annealing, however, appears to have a weakening effect. Compressive residual stresses of about 100,000 psi are found to be present in the curved whiskers during X-ray diffraction studies. M.W.R.

N66-28834# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASTICS Selected Articles
5 Nov. 1965 47 p refs Transl. into ENGLISH from Plasticheskie Massy (Moscow), no. 11, 1964 p 1-9; 37-39; 42-45
(FTD-TT-65-936/1+2; AD-629165) CFSTI: HC $4.60/MF $0.50

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1. PROGRESS IN SYNTHESIS OF NEW POLYMERS M. M. Koton p 1-22 refs (See N66-28835 16-06)
2. STUDY OF THE DEFORMATION OF FILLED FLUOROPLASTIC MATERIALS S. N. Ganz and V. D. Parkhomenko p 23-29 refs (See N66-28836 16-18)
3. SEMICONDUCTOR POLYVINYL CHLORIDE COMPOSITIONS Yu. N. Van-Gaut, L. A. Ol'shanskaya, and R. S. Sokolova p 30-39 refs (See N66-28837 16-18)

N66-28836# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE DEFORMATION OF FILLED FLUOROPLASTIC MATERIALS
S. N. Ganz and V. D. Parkhomenko *In its* Plastics 5 Nov. 1965 p 23-29 refs (See N66-28834 16-18) CFSTI: HC $4.60/MF $0.50

Results are given from tests conducted on the wear resistance and deformation of filled fluoroplastic materials. The fillers used are identified, and a graph is provided which shows the relative deformation of the material versus the

kind of filler that was used. General results indicate that fillers improve the wear resistance and decreases deformation. An analysis of the experimental data indicated that the smallest deformation was obtained for Fluoroplast-4 filled with mark S-1 colloidal graphite. H.S.W.

N66-28837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR POLYVINYL CHLORIDE COMPOSITIONS
Yu. N. Van-Gaut, L. A. Ol'Shanskaya, and R. S. Sokolova *In its* Plastics 5 Nov. 1965 p 30–39 refs (See N66-28834 16-18) CFSTI: HC $4.60/MF $0.50

The electrical characteristics of polyvinyl chloride (PVC) compositions, that are used as shielding sheaths for current conducting and insulating strands were examined. The characteristics studied included the volume resistivity, the surface resistivity, the dielectric permeability, and the tangent of the angle of dielectric losses. Additionally, to determine the influence of the addition of conducting particles on the electrical and mechanical properties of PVC plastics, formulations of hose plastics, with various amounts of gas black or graphite added, were investigated. Because of the compatibility of the PVC plasticates of hose formulations with gas black and graphite, it is reported that homogeneous semiconducting compositions can be obtained. Additionally, the absolute values of the electrical characteristics of the compositions depend on the type of conducting additives in the mixture. Graphs are provided which summarize the data obtained. H.S.W.

N66-28854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASTICS Selected Articles
18 Jun. 1965 25 p refs Transl. into ENGLISH from Plasticheskiye Massy (Moscow), no. 8, 1964 p 20–23; 31–33 (FTD-TT-65-319/1+2+4; TT-65-63105; AD-619482) CFSTI: HC $1.00/MF $0.50

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1. STRENGTH OF GLASS PLASTICS AND ITS DEPENDENCE UPON THE CHANGE IN WETTING ANGLE WITH BINDING OF WATERPROOFED GLASS FIBERS Ye. B. Trostyanskaya, A. M. Poymanov, and Yu. N. Kazanskiy p 1–11 refs (See N66-28855 16-18)
2. MECHANICAL AND FRICTION PROPERTIES OF POLYAMIDE AND POLYETHYLENE COATINGS A. A. Kut'kov and D. T. Avdeyev p 12–17 refs (See N66-28856 16-18)

N66-28855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF GLASS PLASTICS AND ITS DEPENDENCE UPON THE CHANGE IN WETTING ANGLE BINDING OF WATERPROOFED GLASS FIBERS
Ye. B. Trostyanskaya, A. M. Poymanov, and Yu. M. Kazanskiy *In its* Plastics 18 Jun. 1965 p 1–11 refs (See N66-28854 16-18) CFSTI: HC $1.00/MF $0.50

The effect of chemical processing of glass fibers on the strength of glass plastics was investigated by determining the wetting ability of various binders from 20° to 120°C. A sizing film was applied to the glass fibers, and the fibers were further modified by processing with trimethylchlorosilane and by chlorination. Alkaliless glass fibers with grease, and fibers with modified surface were studied with the following tars: epoxy, silicon, phenol-formaldehyde tar solution in fufurole and polyester binder. The wetting angles at various temperatures, the surface tension, and the fiber strengths were measured, and the results tabulated. It was concluded that: (1) the ability of binding agents to wet glass fibers decreases with increased waterproofing; and (2) the strength of epoxy and phenolfurfural glass plastics depends upon the angle of wetting by binders and not upon the presence of a chemical bond between glass fiber and binder. N.E.N.

N66-28856# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICAL AND FRICTION PROPERTIES OF POLYAMIDE AND POLYETHYLENE COATINGS
A. A. Kut'kov and D. T. Audeyev *In its* Plastics 18 Jun. 1965 p 12–17 refs (See N66-28854 16-18) CFSTI: HC $1.00/MF $0.50

The dependence of mechanical strength and friction resistance of polyamide and polyethylene coatings upon the method of application and cooling was investigated. The coatings were tested for shear, bending, and impact strengths, and wear resistance. Gas flame dusting and vortex dusting were used, and the cooling was in open air, water at room temperature, and oil at 180°C. Among the conclusions are: (1) The vortex dusting method assures much higher adhesion of the film to metal, offers much higher and more stable strength values of the film at shear, bending, and impact load than gas flame dusting. (2) Thermal processing changes the structure of polyamide coating; and films cooled in water have an amorphous structure, are more elastic and remain intact at greater deformation. (3) Polyethylene coatings are recommended for machine parts absorbing shock loads, but are unsuitable under deformations. (4) Polyamide coatings can be used for antifriction coatings at small loads. (5) With increase in load the friction coefficient of polyamide on steel decreases, but also the stability of the friction moment decreases considerably. N.E.N.

N66-29015# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RADIATION-INDUCED DIMENSIONAL CHANGES OF GRAPHITES CONTAINING CARBON BLACK
J. W. Helm Mar. 1966 16 p refs
(Contract AT(45-1)-1830)
(BNWL-201) CFSTI: HC $1.00/MF $0.50

Samples of graphite were prepared that contained from 0 to 50% carbon black. At the higher fast neutron exposures, the graphites containing progressively smaller amounts of carbon black showed a progressively greater contraction in both the transverse and parallel directions. At the lower fast neutron exposures, the opposite behavior occurred. At the lower exposures, it appears that the carbon black causes the contraction to proceed so rapidly that the *c*-axis expansion of the crystallites becomes rate controlling, causing the decreased contraction rate. NSA

N66-29132# Naval Radiological Defense Lab., San Francisco, Calif.
SOLUBILITIES OF Kr AND Xe IN FRESH AND SEA WATER
David Wood and Roger Caputi 25 Apr. 1966 17 p refs
(ARPA Order 192)
(USNRDL-TR-988; AD-631557) CFSTI: HC $1.60/MF $0.50

The problem: To determine the solubility of krypton and xenon in fresh water and seawater from 0°C to 50°C. Findings: The results, given in the form of Henry's constant, indicated

a smoothly increasing function with temperature for both krypton and xenon. Henry's constant in seawater for both gases was approximately 25% greater than the corresponding fresh water value. Author (TAB)

N66-29135# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.

NEW METHODS OF MODIFYING THE PROPERTIES OF CELLULOSE

Z. A. Rogovin May 1966 27 p refs Transl. into ENGLISH from Periodica Polytech. (Budapest), v. 5, no. 21, 1961 p 65–87 *Its* Tech. Transl. 15

(TT-66-61109; AD-631595) CFSTI: HC $1.00/MF $0.50

Results obtained in efforts to improve the properties of cellulose and its derivatives are given under the following three categories: (1) the synthesis of new cellulose derivatives; (2) the introduction of new functional groups into the cellulose macromolecule and the accomplishment of additional chemical transformations, utilizing the presence of these groups; and (3) the use of methods of modern synthetic polymer chemistry, in particular the synthesis of block and grafted copolymers of cellulose. Major shortcomings of cellulose fibers which the author states can be eliminated to a considerable degree are: (1) low stability to the action of chemical reagents, (2) low stability to the action of microorganisms and molds, (3) combustibility, (4) insufficiently high light stability, and (5) insufficiently high elasticity. TAB

N66-29208*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL STUDY OF THE OXIDATION OF GRAPHITE IN HIGH-TEMPERATURE SUPERSONIC AND HYPERSONIC ENVIRONMENTS

Irvin M. Miller and Kenneth Sutton Washington, NASA, Jul. 1966 44 p refs

(NASA-TN-D-3444) CFSTI: HC $2.00/MF $0.50 CSCL 11B

An experimental study was made of the oxidation of graphite exposed to high temperature supersonic and hypersonic test streams of air and air–nitrogen mixtures. Oxidation rate data were obtained on hemispherical-shaped models of three grades of graphite over wide ranges of aerothermal parameters to define the oxidation behavior of graphite and to compare this behavior with diffusion-controlled theory. Models of ATJ graphite maintained a smooth shape and oxidized in a consistent manner at a rate below the maximum theoretical rate for diffusion-controlled reactions over a wide range of test conditions. However, most of the models of AHDG and AGSX graphite became distorted at oxygen-mass-flux levels above 0.03 lbm/ft^2-sec (0.146 kg/m^2-s) and at stagnation pressures behind the shock wave above 5.17 atmospheres. Because of equipment limitations, the stagnation pressure and oxygen-mass-flux levels at which this phenomenon begins was not determined. Furthermore, the distorted models of these two grades lost mass in an unpredictable and catastrophic manner at rates ranging up to 2-1/2 times the maximum rate for diffusion-controlled theory. At present, the factors which could explain the distortion effect in AHDG and AGSX graphites are not known. Author

N66-29310# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATION OF THE MECHANICAL PROPERTIES OF FILLED POLYMERS. I: MECHANICAL PROPERTIES OF POLYSTYRENE, POLYMETHYLMETHACRYLATE AND POLYETHYLENE FILLED WITH GLASS FIBRE [VIVCHENNYA MEKHANICHNIKH VLASTIVOSTEI NAPOVNENIKH POLIMERIV MEKHANICHNI VLASTIVOSTI POLISTIROLU, POLIMETILMETAKRILATU TA POLIETILENU, NAPOVNENIKH SKLOVOLOKNOM]

V. P. Solomko, A. G. Zhigotsky, I. A. Uskov, and M. Yu. Kuchinka Mar. 1966 18 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 10, no. 2, 1965 p 211–217

(RAE-LIB-TRANS-1156) CFSTI: HC $1.00/MF $0.50

The authors investigated the concentration dependence of the initial modulus of elongation, the rupture stress and elongation of films of block polystyrene, polymethylmethacrylate and high-pressure polyethylene filled with glass fibre. It is shown that the nature of the polymer and the chemical interaction of the polymer with the filler surface affect the mechanical properties of the filled films obtained from solutions of the respective polymers. The assumption is advanced that the structure formed by the filler and the accompanying structure of the polymer have a definite effect on the mechanical properties of the polymer-filler systems, improving them, as can be seen from the concentration improvement of the initial modulus of extension. The inference is drawn that the mechanism of strengthening of polyethylene films with glass fibre is based on the uniform stress distribution on the cross-section of the sample as well as on the changes in the relaxation processes. Author

N66-29396*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

THERMODYNAMICS OF CRYSTALLINE LINEAR HIGH POLYMERS. V: EXTENDED-CHAIN COPOLYMERS OF POLYETHYLENE

Tamio Arakawa and Bernard Wunderlich [1964] 7 p refs Submitted for Publication

(Grant NsG-100)

(NASA-CR-60460) CFSTI: HC $1.00/MF $0.50 CSCL 11I

The melting behavior of extended-chain copolymer crystals of ethylene with propylene and ethylene with butene-1 is described. Crystallizations were carried out under elevated hydrostatic pressure, density measurements were made, and changes in specific volume were recorded with dilatometers. A differential thermal analysis (DTA) and calorimetric measurements are summarized in tabular form. General trends discovered that the maximum melting point does not change with changing copolymer content; crystallinity as calculated by density measurements decreases almost linearly with increasing concentration of foreign groups; and melting points measured by DTA are somewhat higher than those obtained by dilatometry, indicating that the time allowed for melting was insufficient. It was concluded that the copolymers investigated form at least partially high-melting extended-chain crystals which can be superheated easily. S.P.

N66-29399*# National Aeronautics and Space Administration, Washington, D. C.

LARGE PERIODS IN POLYETHYLENETEREPHTHALATE FILMS [BOL'SHIYE PERIODY V PLENKE POLIETILENTEREFTALATA]

A. I. Kitaygorodskiy, D. Ya. Tsvankin, and Yu. M. Petrov Oct. 1963 13 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (USSR), v. 5, no. 7, 1963 p 1062–1068
(NASA-TT-F-8551) CFSTI: HC $1.00/MF $0.50 CSCL 11I

The intensity distribution of low-angle X-ray scattering from polyethyleneterephthalate films of axially plane texture has been investigated. The major portion of the intensities is concentrated in two domains of the reciprocal space planes. The regions have the shape of a rectangle with the large side normal to the plane of the film. The other, weaker portion of the intensity is in two regions of the surface that interconnect the long sides of the rectangle. The intensity distribution of the low-angle X-ray scattering was compared with the distribution of the crystallite orientation that was studied earlier with the aid of polar figures. The comparison shows that the large period (140 A) is always observed along the axes of the macromolecules. Author

N66-29400*# National Aeronautics and Space Administration, Washington, D. C.
TRANSIENT CURRENTS IN PLASTIC INSULATORS AND THE EFFECTS OF GAMMA-RAY IRRADIATION
Shigeru Ide, Tatsuo Urai, and Hideo Saito May 1964 9 p refs Transl. into ENGLISH from Kobunshi Kagaku (Tokyo), v. 20, no. 222, 1963 p 583–586
(NASA-TT-F-8862) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Thin films of polyethylene, polystyrene, polypropylene, poly (methyl methacrylate), polycarbonate, poly (ethylene terephthalate), and teflon have been irradiated (2.8 megarad) with γ-rays in air at room temperature. Current measurements with a constant dc voltage have been made at room temperature before and after irradiation. The decay of the transient current has been followed for periods ranging from 10 to 7200 sec. Author

N66-29441# National Academy of Sciences—National Research Council, Washington, D. C.
AD HOC COMMITTEE ON INTERFACE PROBLEMS IN FIBROUS COMPOSITES REPORT Final Report
Nov. 1965 58 p refs
(Contract ARPA SD-118)
(MAB-214-M; AD-630256) CFSTI: HC $3.00/MF $0.50

Although glass-reinforced plastics are widely used in missile and other military applications, it is well known that the potential strength of the reinforcing fibers is not achieved in the final composite. There is basis for believing that phenomena associated with the interface are frequently responsible to a significant extent for this limitation. In fibrous composites other than glass-reinforced plastics, problems of fabrication often are dominated by the need for wetting and for securing adequate bonds between fibers and matrix. Here it is evident that the lack of knowledge of the interface and the consequent inability to achieve control of the interface, limit progress in the development of these materials. The report discusses many factors that control the nature of the interface and its influence on the in-service strength of composites. TAB

N66-29458# Naval Ordnance Test Station, China Lake, Calif.
STRENGTH OF REINFORCED PLASTICS UNDERGOING RAPID HEATING
Warren K. Smith Sep. 1965 28 p refs
(NAVWEPS-7869; NOTS-TP-3852; AD-619194) CFSTI: HC $2.00/MF $0.50

Dielectric heating and infrared pyrometry were combined to make possible a method for determining the strength of nonmetallic materials undergoing rapid heating. Test results are presented for 41-RPD phenolic-asbestos plastic laminate with and without postcuring. Author (TAB)

N66-29501# Royal Aircraft Establishment, Farnborough (England).
SOME PROPERTIES OF CONVENTIONAL GLASS-FIBRE INSULATION APPLIED IN SPIRAL FORM TO RESIST MECHANICAL LOADS
P. H. H. Bishop London, Min. of Aviation, Jul. 1961 75 p refs
(RAE-TN-CHEM-1383) CFSTI: HC $3.00/MF $0.75

Light-weight thermal insulating materials which do not compact, and which may be used at temperatures above the limits of conventional foam materials may be prepared by winding strips of glass-fibre felt into spirals, thus utilizing the better orientation of the fibre to resist mechanical load and the curvature of the strip to improve stability in compression. Impregnation of the spirals with a silicone resin improves their properties below 300°C. The spiral materials have densities ranging from 0.7 to above 10 lb/ft^3, possess useful thermal and mechanical properties, and are non-brittle from −190° to +600°C. The materials are not inflammable and may be made water repellent. Author

N66-29737*# Case Inst. of Tech., Cleveland, Ohio. Polymer Science Group.
INFRARED STUDIES OF CHAIN FOLDING IN POLYETHYLENE TEREPHTHALATE, PART A: Status Report, Oct. 31, 1965–Apr. 30, 1966
Martin J. Hannon and J. L. Koenig [1966] 72 p refs
(Grant NGR-36-003-054)
(NASA-CR-76011) CFSTI: HC $3.00/MF $0.75 CSCL 11I

An infrared method has been developed for analyzing the spectra of a semicrystalline polymer for bands arising from the folded chain. The basis of the assignment is the contrasting behavior of crystalline and fold bands during annealing and degradation. The method has been applied to polyethylene terephthalate (PET), and as a result the 988 cm^{-1} band has been assigned to a fold conformation. This assignment was utilized in studying the effects of crystallization, annealing, and deformation upon folding in PET. Melt and solution crystallized PET exhibit a high degree of folding as measured by the 988 cm^{-1} band. This is consistent with current theories of crystallization. Annealing results indicate the possibility of two types of folding. Strain induced crystallization produces no regular folding, as measured by the 988 cm^{-1} band, but heat setting does. Deformation of crystalline samples containing folds has been shown to disrupt the regular fold, which reperfects itself upon subsequent annealing. Author

N66-29753*# RAI Research Corp., Long Island City, N. Y.
DEVELOPMENT OF A PROTOTYPE PLASTIC SPACE ERECTABLE SATELLITE Quarterly Report, Mar.–May 1966
Vincent D'Agostino, Preston Kausch, and John Raffo 27 Jun. 1966 67 p refs
(Contract NAS5-3923)
(NASA-CR-76045; RAI-368) CFSTI: HC $3.00/MF $0.50 CSCL 11I

High density and standard density polyethylene films were tested to determine their tensile properties, and the data are tabulated. The standard polyethylene film was found acceptable, and samples were irradiated and heat treated under

different ambient conditions to evaluate the effects of atmosphere on the processed film. Results indicate little influence on the mechanical properties. Calculations were also made to determine the thickness of film required to withstand a buckling pressure of five times solar pressure. Findings show a thickness requirement in the 0.50 to 1.48 mils range. M.G.J.

N66-29757*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
STUDY OF THE EFFECTS OF ETHYLENE OXIDE–FREON 12 UPON PROPERTIES OF POLYMERS AND METALLIC SURFACES Final Report, 10 Oct. 1964–31 Mar. 1966
R. F. Rydelek and A. L. Landis [1966] 101 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951003)
(NASA-CR-76039; P66-96) CFSTI: HC $4.00/MF $0.75 CSCL 11D

Sixty-eight commercial polymeric products were exposed to the following two-step spacecraft sterilization procedure: 48 hours in an atmosphere of 12 percent ethylene oxide–Freon 12 sterilant gas at 30–50 percent relative humidity followed by 108 to 120 hours at 145°C under a dry nitrogen atmosphere. Physical, mechanical, and electrical tests were performed on materials to determine the amount of degradation caused by each step and to establish the compatibility of products with the entire procedure. Although all products showed a change in properties after gas exposure, and an additional change after dry heat cycling, only two were rated not compatible, and 18 as marginal. The mechanism study indicated that both pure and commercial products are capable of adsorbing up to four percent by weight of sterilant gas. Compounds released all but a fraction of a percent of the adsorbed gas when exposed to a vacuum. In most cases, exposure to dry heat cycling after gas and vacuum exposure produced a net weight loss in test materials. Author

N66-29950# Air Force Cambridge Research Labs., Bedford, Mass.
THE AFCRL FLYING THREAD LOOM PROCESS FOR IMPROVED SCRIM REINFORCED BALLOON MATERIALS
Arthur O. Korn, Jr. Feb. 1966 25 p ref *Its* Instrumentation Paper No. 92
(AFCRL-66-99; AD-632538) CFSTI: HC $1.00/MF $0.50

The cost of reliable, scrim-reinforced balloon materials has been substantially reduced through use of the AFCRL flying thread loom (FTL). This versatile machine promises to extend the present capabilities of scientific ballooning by providing improved lightweight materials for extreme altitudes and thin films of unusual strengths for extra-heavy payloads. The principle of operation is described and results of flight tests using two new FTL materials are reported. Savings in cost and in balloon volume requirements are demonstrated by charts. Future plans include addition of a gore-cutting and tailoring device and a card-input control mechanism. Author (TAB)

N66-29974*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report No. 3, Mar. 1–May 31, 1966
James F. Bacon 30 Jun. 1966 11 p ref
(Contract NASw-1301)
(NASA-CR-76084; E910373-3) CFSTI: HC $1.00/MF $0.50 CSCL 11B

The third quarter's research increased the number of glass compositions under consideration from 45 to 69, the number of glass batches melted at least once from 40 to 57, the number of glasses characterized by measurement of Young's modulus from 5 to 15 and those characterized by viscosity measurements from 3 to 13. However, the value of 15×10^6 pounds per square inch obtained in the measurement of the Young's modulus of the first oxide system selected for investigation ($Mg_2Al_4Si_5O_{18}$) has not been bettered as yet. The equipment used for the dynamic measurement of Young's modulus has been greatly improved to permit the measurement of resonant frequencies of glass rods over the range of 1000 to 40,000 cycles per second (Hz). Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-28429# Joint Publications Research Service, Washington, D. C.
METHODS OF QUANTITATIVE ANALYSIS OF COMPLEX SYSTEMS
D. B. Yudin *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 1–19 refs (See N66-28428 16-10) CFSTI: $6.00

The discussion of the methods of mathematical programming—the formal apparatus for investigation in synthesis of complex systems—is continued. Various versions of random search are considered, and means of rational organization of the process of finding the global extremum in multiextremal problems are investigated. Author

N66-28431# Joint Publications Research Service, Washington, D. C.
STATISTICAL SELECTION OF REQUESTS IN A QUEUEING SYSTEM WITH REJECTIONS
A. A. Naten *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 35–40 (See N66-28428 16-10) CFSTI: $6.00

In the practical realizations of queueing systems (control systems, diagnostic systems, recognition systems) the essentially limited carrying capacity of the servicing device may bring about the necessity of organization of a preliminary selection of requests for the purpose of thinning the flow. In a number of cases, using the basic assumptions of the theory of statistical solutions, it is possible to mark a path of optimization of the selection with respect to the criterion of minimum probability of skipping an object submitted for servicing. In the given article this problem is considered as applied to a servicing system with rejections (without memory). Author

N66-28488*# Brown Univ., Providence, R. I.
A CLASS OF LINEAR FUNCTIONAL EQUATIONS
J. K. Hale [1966] 15 p refs Presented at the Intern. Congr., Moscow, Aug. 1966
(Contracts NGR-40-002-015; DA-31-124-ARO-D-270; Grant AF-AFOSR-693-66)
(NASA-CR-75725) CFSTI: HC $1.00/MF $0.50 CSCL 12A

A summary of unpublished results concering a class of autonomous linear functional equations is presented. Included are autonomous linear functional differential equations of retarded and neutral type as well as functional difference equations. G.G.

N66-28506*# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ON AN APPROXIMATION THEOREM OF KUPKA AND SMALE
M. M. Peixoto [1964] 25 p refs
(Grants NGR-40-002-015; NSF GP-4632)
(NASA-CR-75734) CFSTI: HC $1.00/MF $0.50 CSCL 12A

A simplified and generalized proof is presented for the following approximation theorem concerning differential equations defined on a compact C^∞ differentiable manifold M^n. Let X be the space of all C^r vector fields X on M with the C^r topology, $r \geq 1$. It is assumed that M is endowed with a Riemannian metric. Let G_i, i = 1, 2, 3, be the set of all $X \in X$ satisfying the conditions G_i: G_1—the singularities of X are generic, and therefore finite in number; G_2—the closed orbits of X are generic; G_3—the stable and unstable manifolds associated with the generic singularities and closed orbits are transversal. Finally, let $G = G_1 \cap G_2 \cap G_3$. Then, G is residual in X. The simplification and generalization are based upon the use of stable and unstable manifolds, and the existence of a minimum positive τ for the period of the closed orbits. This latter permits the use of a simple transversality argument on the Poincaré transformation rather than the delicate argument involving the iterates of the transformation. It is finally noted that the results are extended to open manifolds. D.T.

N66-28558# International Business Machines Corp., San Jose, Calif. Research Div.
A DECOMPOSITION TECHNIQUE FOR NONLINEAR PROGRAMMING
Pravin Varaiya 1 Jul. 1965 30 p ref
(RJ-345)

The solution, by decomposition, of a class of large convex programming problems is proposed. The problem is assumed to consist of subproblems with individual convex constraints and linear coupling constraints. The cost function is assumed to be separable and strictly concave. The decomposition technique is due to Lasdon. A simple account of this technique is presented and a rigorous proof for the main theorem is given. An extension to a different class of problems is sketched. Author

N66-28663# Case Inst. of Tech., Cleveland, Ohio.
OPTIMIZATION OF COUPLED SYSTEMS BY DECOMPOSITION
Lawrence J. Munini (M.S. Thesis) Jun. 1966 64 p refs
(Grant DA-ARO(D)-31-124-G647)
(AROD-5510-1; AD-478509)

A general optimization problem, involving both equality and inequality constraints, is specialized to the case of coupled subsystems. A two-level decomposition algorithm which involves solving a minimax problem is then stated. Computational experience with the method when used in conjunction with second order gradient minimization algorithms is presented. Included is the extension of the technique to the class of problems that yield linear subproblems. Author (TAB)

N66-28751# Oak Ridge National Lab., Tenn.
STOCHASTIC DIFFERENCE EQUATIONS OCCURRING IN ONE-COMPARTMENT MODELS
V. R. Rao Uppuluri, P. I. Feder (Stanford Univ.), and L. R. Shenton (Georgia Univ.) Apr. 1966 34 p refs
(Contract W-7405-ENG-26)
(ORNL-3920) CFSTI: HC $2.00/MF $0.50

Bernard, Uppuluri, and Shenton earlier considered a simple model for the distribution of radioactive material in a multicompartment system. In this model, the system initially holds unit mass of radioactive material and then emits this according to a random mode of decay. A one compartment system is considered here in which radioactive materials are injected at unit time intervals to compensate for material that has decayed. Two models for injection and decay were considered. The first model corresponds to unit pulsing and random decay and the second model corresponds to random pulsing and constant decay. NSA

N66-29020# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center.
THE EXPONENTIAL TRANSFORM AS AN IMPORTANCE-SAMPLING DEVICE—A REVIEW
Francis H. Clark Jan. 1966 57 p refs
(Contract W-7405-ENG-26)
(ORNL-RSIC-14) Available from Oak Ridge Natl. Lab., Tenn.

The exponential transform is reviewed, with emphasis on its use as a guide to effective importance sampling in the solution of the Boltzmann equation by Monte Carlo methods. Contributions of various workers are assembled, along with numerical results. Special consideration is given to approximate forms and to effective practical methods. Problems related to negative effective cross sections, tracking across discontinuities, directional biasing in inhomogeneous media, and high variance in back-scattered components are specifically treated. Author (NSA)

N66-29021# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center.
A SURVEY OF EMPIRICAL FUNCTIONS USED TO FIT GAMMA-RAY BUILDUP FACTORS
D. K. Trubey Feb. 1966 120 p refs
(Contract W-7405-ENG-26)
(ORNL-RSIC-10) Available from Oak Ridge Natl. Lab., Tenn.

The use of simple functions to estimate gamma buildup factors is reviewed on the basis of simplicity and accuracy. Analysis shows that the best fitting form is the 4 term polynomial fit with coefficients published by Capo. For most purposes, however, a function proposed by Berger is recommended since it is as simple to use as the linear form and is essentially as good as the more complicated forms. Tables of the coefficients are given for the linear, quadratic, Berger, and Taylor fitting functions. Some typical graphs of the functions are also given. Use of the Berger and polynomial functions is demonstrated for the case of exponential source distributions in plane geometry and the use of buildup factors in finite geometry is briefly described. Author (NSA)

N66-29040# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CALCULATION OF THE INTEGRALS OF SOME BESSEL FUNCTIONS [CALCUL D'INTEGRALES DE QUELQUES FONCTIONS DE BESSEL]
Lucienne Gautier and Christian Bardin Dec. 1965 66 p in FRENCH
(CEA-R-2927)

The functions: $E_n(x) = \int_1^\infty (e^{-xt}/t^n)\,dt$, $K_{in}(x) = (1/x^n)\int_0^x u^n K_0(u)\,du$, $K_{in}(x) = \int_0^{\Pi/2} 2\sin^{n-1}\theta e^{-(x/\sin\theta)}\,d\theta$, and $S_{mn}(\eta) = \int_0^{\Pi/2} \cos^n\phi K_{im+1}(2\eta\cos\phi)\,d\phi$ were calculated for all values of the variable and for a wide range of variation of the parameters, using methods which are described here.

Author (NSA)

N66-29182# Hebrew Univ., Jerusalem (Israel).
UNIFORM EXTENSION OPERATORS FOR MODELS AND THEIR APPLICATIONS
Haim Gaifman Dec. 1965 58 p refs Presented at the 1965 Logic Colloq., Leicester, England
(Contract N62558-3882)
(TR-21; AD-631784) CFSTI: HC $3.00/MF $0.50

The notion of an operator which maps in a uniform way every model in its domain to a proper elementary extension, is defined. Applications concerning models with 'many' automorphisms, as well as the structure of models of Peano's arithmetic are proved. Author (TAB)

N66-29189# Illinois Univ., Urbana. Dept. of Computer Science.
GENERALIZED DECOMPOSITION OF INCOMPLETE FINITE AUTOMATA
Arthur Ta-Shiang Pu (Ph.D. Thesis) 30 Dec. 1965 76 p refs
(Contract Nonr-1834(27))
(Rept.-194; AD-631782) CFSTI: HC $3.00/MF $0.75

This work is an extension to the problem of generalized decomposition where two-way interconnections between automata are permitted. The study is mainly concerned with decompositions for a deterministic incomplete finite automaton. The problem is to find, for a given incomplete automaton M, a generalized N-tuple decomposition (GND) $[M_i]_{1\le i\le N}$ such that for each i, M_i has a complexity equal to or less than a given bound, and furthermore, the total number of interconnecting lines is a minimum over all such decompositions. The results include the known results for series and parallel decomposition of an automaton as special cases. The question is raised of whether it is sufficient to consider just set systems in the general theory of decomposition for automata. The theory of generalized pair decomposition is extended to GND. It is shown that any GND of M can be obtained from successive pair-wise decomposition. R.N.A.

N66-29191# United States Steel Corp., Monroeville, Pa.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY REGULAR PENTATOPE-ORTHOGRAPHIC PROJECTIONS
C. Ernesto and S. Lindgren Mar. 1965 15 p ref Presented at the Eng. Graphics Seminar, Princeton, N. J. *Its* Spec. Rept.-2
(AD-631307) CFSTI: HC $1.00/MF $0.50

This paper defines a pentatope and indicates the step by step procedure for obtaining the orthographic projections of the regular pentatope. The method of checking the true length of the edges is also indicated. A set of figures showing the orthographic projections of each of the five tetrahedrons is included. R.N.A.

N66-29235*# Northwestern Univ., Evanston, Ill. Dept. of Geography.
MEASURES OF DISTANCE FROM A RANDOMLY LOCATED POINT TO NEIGHBORING LATTICE POINTS FOR RECTANGULAR AND HEXAGONAL POINT LATTICES Technical Report No. 3
Michael F. Dacey Dec. 1965 25 p refs Sponsored in part by NASA
(Contract Nonr-1228(35))
(NASA-CR-75948; AD-631751) CFSTI: HC $2.60/MF $0.50
CSCL 12A

This report lists the probability density function and distribution function of distance from a point randomly located in a polygon to the ith nearest corner for the following polygons: square, diamond, and rectangle. Also, low order moments and moment constants are tabulated for these order distances. The three lowest orders of distance for the square and the diamond pertain identically to the three lowest orders of distance for the square and hexagonal lattices, and the two lowest orders of distance for the rectangle apply identically to the two lowest orders of distances for the primitive rectangular lattice. Author (TAB)

N66-29243# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
SOME CODES WHICH ARE INVARIENT UNDER A DOUBLY-TRANSITIVE PERMUTATION GROUP AND THEIR CONNECTION WITH BALANCED INCOMPLETE BLOCK DESIGNS Scientific Report No. 6
Tadao Kasami and Shu Lin 28 Jan. 1966 16 p refs
(Contract AF 19(628)-4379)
(AFCRL-66-142; AD-631865) CFSTI: HC $1.00/MF $0.50

If a binary code is invariant under a doubly-transitive permutation group, then the set of all code words of weight j forms a balanced incomplete block design. Besides the extended normal BCH codes and the extended quadratic residue codes, the Reed–Muller codes are proven to be invariant under a doubly-transitive permutation group. Thus, BIB designs can be derived from these classes of codes. It is shown that if the symbols of the Reed–Muller codes are properly arranged, and if the first digit is omitted, then all Reed–Muller codes are cyclic. Author (TAB)

N66-29245# Washington Univ., Seattle. Dept. of Electrical Engineering.
ON THE GENERAL SOLUTIONS OF COUPLED-MODE EQUATIONS WITH VARYING COEFFICIENTS
Yung-sen Chen and Akira Ishimaru Feb. 1966 38 p refs *Its* Tech. Rept.-103
(Contract AF 19(628)-2763)
(AFCRL-66-163; AD-631990) CFSTI: HC $2.00/MF $0.50

In this report a systematic mathematical method is introduced for the solution of problems involving two coupled modes in a coupled system with varying parameters. These problems involve systems of linear differential equations with varying coefficients. By the use of a linear transformation of the dependent variables and a double diagonalization process, the coupled mode equations are reduced to two decoupled Riccati equations. The final form of the general solution is obtained in terms of four varying coupling coefficients and a transform parameter. To illustrate some applications of the method, solutions of two special cases which have been solved previously by other workers are obtained. The solutions for a number of special cases, in which the varying coefficients are specified or interrelated, are also obtained. Further possible applications are indicated. Author (TAB)

N66-29254# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MONTE CARLO INVESTIGATION OF THE PROBABILITY DISTRIBUTIONS OF DIXON'S CRITERIA FOR TESTING OUTLYING OBSERVATIONS

Walter L. Mowchan Jan. 1966 50 p refs
(BRL-MR-1716; AD-632174) CFSTI: HC $4.60/MF $0.50

An empirical or Monte Carlo method for determining the distribution of Dixon-type sample statistics for testing outlying observations is presented. Results are tabulated for samples generated from a normal distribution and for samples generated from a uniform distribution. The method employed was to select random samples of sizes n = 5, 10, 15 and 20 from each of the aforementioned distributions. After ordering the sample values such that $X_1 < X_2 \ldots < X_n$, six different statistics for each sample size for each distribution were computed. A sampling distribution was therefore obtained empirically for each sample size for each distribution after 500 such sample trials. Finally, the upper α probability levels or percentage points are tabulated for each sample size for each distribution. Author (TAB)

N66-29646# Montana Univ., Missoula. Computer Center.
NUMERICAL SOLUTION OF NONLINEAR EQUATIONS
P. W. Card Jun. 1966 132 p refs
(TR-5)

The problem of finding the roots of nonlinear equations is considered, i.e., some of the techniques for finding the zeros of f(x) where f(x) may be a polynomial, transcendental, or other nonlinear function, are summarized. Author

N66-29669*# Minnesota Univ., Minneapolis.
AN ENGINEERING APPROACH TO NONLINEAR ESTIMATION
J. H. Park, Jr. [1965] 22 p
(Grant NsG-712)
(NASA-CR-75892) CFSTI: HC $1.00/MF $0.50 CSCL 12A

In the proposed solution to this problem the signal processing equipment is restricted to be linear time invariant circuits "read" sometime in the observation interval, followed by a quantizer and digital computer. The various impulse responses of the linear circuits are designed to be orthogonal over the interval [O,T]; hence, they span a subspace, S_s, of function space. The computer operates on the components of the data in this subspace. The computer operations are restricted to be linear or multiplication/division or square/square root. It is shown how maximum likelihood estimators and Bayes estimators with a quadratic cost function for a large class of parameters can be determined exactly or closely approximated using the above techniques. Several examples are worked out in detail such as the estimation of the width of a pulse and first order optimum detection of am and fm signals. Author

N66-29572*# Maryland Univ., College Park. Computer Science Center.
PARTIALLY ORDERED SPACES AND NEWTON'S METHOD FOR CONVEX OPERATORS
James S. Vandergraft (Ph.D. Thesis) May 1966 81 p refs
(Grant NsG-398)
(NASA-CR-75898; TR-66-29) CFSTI: HC $3.00/MF $0.75 CSCL 12A

Some general theorems are proved concerning Newton's method applied to convex operators which are defined on partially ordered topological linear spaces. The spaces are examined and various relations between the partial ordering and the topology are discussed. A mean value theorem is proved and is then used to study convex operators. Several convergence theorems for Newton's method are obtained and applications to differential and integral equations are given. Finally, these results are used to simplify a theorem of Kantorovich concerning the convergence of Newton's method applied to operators which are defined on spaces with partially ordered norm. Author

N66-29573*# Maryland Univ., College Park. Computer Science Center.
AN EMPIRICAL EVALUATION OF THE EFFECTS OF VIOLATING THE ASSUMPTION OF HOMOGENEITY OF COVARIANCE FOR THE REPEATED MEASURES DESIGN OF THE ANALYSIS OF VARIANCE
Peter H. Stoloff (M.S. Thesis) May 1966 79 p refs
(Grant NsG-398)
(NASA-CR-75900; TR-66-28) CFSTI: HC $3.00/MF $0.75 CSCL 12A

The results of this study indicate that as degree of freedom (d.f.) and heterogeneity of covariance increased in the population, the approximations to the central F distribution and the T^2 test become increasingly more effective in accounting for bias in the F statistic result from violations of the model. When the power of the various tests was investigated over the various values of noncentrality, it was found that the overall level of power for the exact F remained relatively invariant when the model was violated. When the approximate procedures using the F distribution were used when violations of the model for the exact F was present in the population, and hence "logically" appropriate, the power of these tests approached that of the exact F. Descriptive measures of the distribution of epsilon revealed the sample estimates of the parameter to be best when sampling from the extreme ranges of the domain of the statistic. As the d.f. in the covariance matrix increased, differential prediction of the parameter, given the sample mean, improved. Author

N66-29602# Catholic Univ. of America, Washington, D. C. Dept. of Mathematics.
ON CHARACTERIZATION OF EMBEDDINGS AND QUOTIENT MAPS, PART III
Isidore J. Heller 25 Feb. 1965 15 p refs
(Contract Nonr-4311(00))
(TR-660131; AD-630258) CFSTI: HC $1.60/MF $0.50

Part II studies conditions entailing a point-free characterization, first of the class B of one-to-one onto maps, and subsequently of the classes of embeddings, quotient maps, one-to-one maps and of onto maps, in terms of B.
Author (TAB)

N66-29604# RAND Corp., Santa Monica, Calif.
QUASILINEARIZATION AND THE ESTIMATION OF DIFFERENTIAL OPERATORS FROM EIGENVALUES
R. E. Bellman, H. H. Kagiwada, R. E. Kalaba, and R. Vasudevan Mar. 1966 14 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4915-PR; AD-630247) CFSTI: HC $1.00/MF $0.50

Given a linear ordinary differential operator containing several unknown constants and a number of its eigenvalues, the values of the unknown constants are estimated. A precise formulation is provided, and an effective numerical procedure for solution is indicated. The results of some computational experiments are given. TAB

N66-29695# Hebrew Univ., Jerusalem (Israel).
ON CONCATENATIVE DECOMPOSITIONS OF REGULAR EVENTS

A. Paz (Israel Inst. of Tech.) and B. Peleg Aug. 1965 29 p refs Prepared in cooperation with Israel Inst. of Tech.
(Contract N62558-3882)
(TR-20; AD-631863) CFSTI: HC $2.00/MF $0.50

The notion of a decomposition state, introduced by the authors in their previous work on ultimate and symmetric definite automata, is generalized and utilized with a view to a canonical decomposition for regular events. Various possible decomposition types of regular events are introduced and discussed. Author (TAB)

N66-29731*# Maryland Univ., College Park. Computer Science Center.
ORTHOGONAL POLYNOMIALS ON A FINITE POINTSET
Charles K. Mesztenyi May 1966 24 p
(Grant NsG-398)
(NASA-CR-75993; TR-66-30) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Orthogonal polynomials on a finite number of points are examined, and an equation is formulated for defining orthogonality. A relationship is derived between the sets of orthogonal polynomials, and an algorithm for polynomial least square fit is presented based on these results. M.G.J.

N66-29736*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ACCURACY STUDY OF CENTRAL FINITE DIFFERENCE METHODS IN SECOND ORDER BOUNDARY VALUE PROBLEMS
Nancy Jane Cyrus (M.S. Thesis—Va. Polytechn. Inst.) Jun. 1966 80 p refs
(NASA-TM-X-57692) CFSTI: HC $3.00/MF $0.75 CSCL 12A

An accuracy study is made of central finite difference methods for solving boundary value problems which are governed by second order differential equations with variable coefficients leading to odd order derivatives. Three methods are studied through applications to selected problems. Definitive expressions for the error in each method are obtained by using Taylor series to derive the differential equations which exactly represent the finite difference approximations. The resulting differential equations are accurately solved by a perturbation technique which yields the error directly. A half station method, which corresponds to making finite difference approximations before expanding derivatives of function products in the differential equations, was found superior to two whole station methods which correspond to expanding such products first. Author

N66-29809# Pisa Univ. (Italy).
THE MINIMUM PRINCIPLE IN THE CALCULUS OF VARIATIONS [IL PRINCIPIO DI MINIMO NEL CALCOLO DELLE VARIAZIONI]
Guido Stampacchia Turin, Acad. of Sci., 1964 23 p refs In ITALIAN; ENGLISH summary
(Grant AF-EOAR-63-29)
(AFOSR-65-1031; AD-619541) CFSTI: HC $1.00/MF $0.50

The note reports developments of the minimum principle in the theory of elliptic partial differential equations. TAB

N66-29825# Wisconsin Univ., Madison. Mathematics Research Center.
OPTIMAL REGULATION OF LINEAR SYMMETRIC HYPERBOLIC SYSTEMS WITH FINITE DIMENSIONAL CONTROLS
David L. Russell May 1965 62 p refs
(Contract DA-11-022-ORD-2059)
(MRC-586; AD-620104) CFSTI: HC $3.00/MF $0.75

Finite dimensional control of a class of linear symmetric hyperbolic systems of partial differential equations is considered. The control criterion is minimization of the energy of the system at a given time T after the exercise of control is begun. It is shown that the optimal control exists and satisfies a maximum principle. A type of normality condition is discussed. It is shown that a class of boundary value control problems can be treated in this setting. Some numerical procedures are suggested. Author (TAB)

N66-29831# Maryland Univ., College Park.
FUNDAMENTAL RESEARCH IN APPLIED MATHEMATICS Final Report, 1 Jul. 1964–30 Jun. 1965
M. H. Martin and W. Rheinboldt Jul. 1965 13 p refs
(Grant DA-ARO(D)-31-124-G-563)
(AROD-407-68; AD-619461) CFSTI: HC $1.00/MF $0.50

Topics covered in the report include: (1) Uniqueness of problems involving partial differential inequalities; (2) Functional-analytic methods in numerical analysis; (3) Partial differential equation; and (4) Mathematical physics. (TAB)

N66-29834# Carnegie Inst. of Tech., Pittsburgh, Pa. Management Sciences Research Group.
OBSERVING STOCHASTIC PROCESSES, AND APPROXIMATE TRANSFORM INVERSION
Donald P. Gaver, Jr. Jun. 1965 27 p refs
(Contract Nonr-760(24))
(RR-41; AD-616760) CFSTI: HC $2.00/MF $0.50

This paper describes a probabilistic interpretation of the Laplace transform solutions of problems arising in applied probability, e.g., congestion theory. The interpretation is adapted for automatic computation, and is supplemented by an extrapolation to the limit procedure to obtain approximate values for inverse transforms. The approximations are examined for functions with known inverses, and appear satisfactory. The method is applied to study the time-dependent evolution of the expected waiting time at a single-server queue; the results obtained are compared to those derived from asymptotic formulas and exhibit satisfactory agreement. Author (TAB)

N66-29836# California Univ., Los Angeles. Dept. of Mathematics.
ACCELERATION OF THE CONVERGENCE OF THE KACZMARZ METHOD AND ITERATED HOMOGENEOUS TRANSFORMATIONS
James Dyer (Ph.D. Thesis) 1965 106 p refs
(Contract Nonr-233(76))
(Rept.-65-2; AD-621582) CFSTI: HC $4.00/MF $0.75

The Kaczmarz method is a well known and computationally easily constructed iterated method for solving a system of linear equations. Convergence is normally slow due to the presence of an eigenvalue with modulus close to unity. Two related methods of accelerating this convergence are considered. The accelerated transformations are nonadditive and homogeneous. In a natural way arises the question of defining suitable finite and asymptotic rates of convergence for certain convergent nonlinear homogeneous transformations. The rate of convergence problem is re-examined for linear transformations and a new average rate for a finite number of iterations is defined. Aspects of Ergodic theory are

discussed in connection with an important class of linear transformations. Classes of homogeneous transformations are defined to which the theory of rate of convergence can be extended. Ergodic theorems are proved concerning certain homogeneous transformations in the plane. The relationship of the Kaczmarz operator to the Gauss-Seidel operator is recalled and some aspects of the Young overrelaxation theory are applied to the former. The dissertation concludes with some graphed results showing the effect of accelerating the convergence of the Kaczmarz method. Author (TAB)

N66-29848# California Univ., Los Angeles. Western Management Science Inst.

SOME METHODS FOR CLASSIFICATION AND ANALYSIS OF MULTIVARIATE OBSERVATIONS

James B. Mac Queen Mar. 1966 31 p refs *Its* Working Paper No. 96

(Contract Nonr-233(73))

(AD-632526) CFSTI: HC $2.00/MF $0.50

This paper describes a number of applications of the 'k-means', a procedure for classifying a random-sample of points in E_N. The procedure consists of starting with k groups which each consist of a single random point, and thereafter adding the points one after another to the group whose mean each point is nearest. After a point is added to a group, the mean of that group is adjusted so as to take account of the new point. Thus at each stage there are in fact k means, one for each group. After the sample is processed in this way, the points are classified on the basis of nearness to the final means. The portions which result tend to be efficient in the sense of having low within class variance. Applications are suggested for the problems of non-linear prediction, efficient communication, non-parametric tests of independence, similarity grouping, and automatic file construction. The extension of the methods to general metric spaces is indicated. Author (TAB)

N66-29879# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

ESTIMATION OF THE DOMAIN OF ATTRACTION

Gunther R. Geiss Mar. 1966 37 p refs Presented at 24th Guidance and Space Flight Theory Seminar, Huntsville, Ala., 16-17 Feb. 1966 Submitted for Publication

(RM-316J)

A survey of various approaches to the problem of estimating the domain of attraction of an equilibrium solution to a system of nonlinear autonomous differential equations is given. Based upon observations resulting from this survey the problem is reformulated as that of optimally choosing the Liapunov function from the space of positive definite quadratic forms. An estimate of the domain of attraction is then obtained as the solution of a minimization problem. This approach to the problem has the advantages of: (1) being designed specifically for machine computation; (2) yielding an estimate that is readily visualized; and (3) being relatively insensitive to system dimension. Some preliminary numerical results are presented for the Duffing equation with damping. Author

N66-29890# System Development Corp., Santa Monica, Calif.

A PROBLEM IN STATIC STORAGE ALLOCATION

Yoichiro Fukuda 20 Apr. 1966 28 p refs

(SP-2435/000/00; AD-632475) CFSTI: HC $2.00/MF $0.50

A primary objective of static allocation considered in this paper is to achieve efficiency in the internal operation of systems whose requirements are given and fixed, and whose function is to perform a number of different consecutive jobs. The sage system is a good example—the various programs and data in the system must be available in a predetermined sequence at specified times, and core storage space must be allotted to the programs and data in the most economical way. An algorithm is presented for deriving an optimal allocation scheme. This algorithm closely resembles, in spirit a 'branch and bound' algorithm for the traveling salesman problem. Author (TAB)

N66-29921# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

TEN PLACE TABLES OF THE JACOBIAN ELLIPTIC FUNCTIONS

Henry E. Fettis and James C. Caslin Sep. 1965 571 p refs

(ARL-65-180, Pt. 1; AD-631869) CFSTI: HC $8.70/MF $2.50

The report contains ten place tables of the Jacobian elliptic functions am(u,k) sn(u,k) cn(u,k) dn(u,k), E(am(u,k)).

TAB

N66-29929# California Univ., Berkeley. Center for Research in Management Science.

A NOTE ON MAXIMAL POINTS OF CONVEX SETS IN l_∞

Roy Radner Jan. 1966 12 p refs

(Contract Nonr-222(77))

(TR-22; AD-631975) CFSTI: HC $1.00/MF $0.50

The problem of characterizing maximal points of convex sets arises in the study of admissible statistical decision procedures, of efficient allocation of resources, and of mathematical programming. This note generalizes to l_∞ a theorem that Arrow, Barankin, and Blackwell proved for finite dimensional vector spaces. Let X be the Banach space of all bounded sequences of real numbers, with the sup norm topology, and partially ordered coordinatewise (i.e., $x=(x_n)$ is $\geq x'=(x'_n)$ means that $x_n \geq x'_n$ for every n). Let Y be the space of all continuous linear functionals on X, with the weak* topology, and define $y \geq 0$ to mean $y(x) \geq 0$ for all $x \geq 0$ in X, and $y \gg 0$ to mean $y(x) > 0$ for all $x \geq 0$, $x \neq 0$ in X. Let S be the set of all non-negative y in Y with norm 1, and let S^+ be the set of all $y \gg 0$ in S. It is shown that if $\hat{x}$ is maximal in a compact convex subset C of X, then there is a $\hat{y}$ in S such that (1) $\hat{x}$ maximizes $\hat{y}(x)$ on C, and (2) $(\hat{x},\hat{y})$ is the limit of a generalized sequence (s^m, y^m) of points in $C \times S^+$ such that for each m, x^m is maximal in C and maximizes $y^m(x)$ on C. Author

N66-29933# Northwestern Technological Inst., Evanston, Ill. Systems Research Group.

SOME SPECIAL P-MODELS IN CHANGE-CONSTRAINED PROGRAMMING

Abraham Charnes and Michael J. L. Kirby (Research Analysis Corp.) Aug. 1965 23 p refs *Its* Systems Res. Mem. No. 135

(Contract Nonr-1228(10); DA-31-124-ARO-D-322)

(AD-632107) CFSTI: HC $1.00/MF $0.50

Sufficient conditions are derived for decision rules to be optimal for two classes of n-period P-models of chance-constrained programming. It is shown that the optimal rule for period j is the optimal piecewise linear function of the decision rules of previous periods and certain fractile points. The optimal class of rules is shown to be the same for the n-period P-model as for the corresponding n-period E-model. Author (TAB)

N66-29948# Illinois Univ., Urbana.
REMARKS ON THE LIFTING PROPERTY AND THE DISINTEGRATION OF MEASURES
C. Ionescu Tulcea Jun. 1965 19 p ref
(Contract DA-31-124-ARO-D-288)
(AROD-5254-8; AD-632015) CFSTI: HC $1.00/MF $0.50

Contents: On a theorem of G. Mokobodzski; Remark Concerning The Disintegration of Measures; and Decomposition Into Ergodic Parts. TAB

N66-29975*# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL STATIONARY CONTROL OF A LINEAR SYSTEM WITH STATE-DEPENDENT NOISE
W. M. Wonham Jun. 1966 30 p refs
(Grants NGR-40-002-015; AF-AFOSR-693-66; NSF GK-967)
(NASA-CR-76085; CDS-TR-66-2) CFSTI: HC $2.00/MF $0.50
CSCL 12A

It is shown that linear optimal control exists for the general linear control system described by $f'(x)=Ax-Bu+Cf'(w_1)+G(x)f'(w_2)$, provided that the state dependent noise, $G(x)f'(w_2)$, is sufficiently small. In the equation, u is the control and $f'(w_1)$ and $f'(w_2)$ are independent Gaussian white noise disturbances. The elements of the matrix G are assumed to be linear in x; and thus, the state dependent noise intensity is roughly proportional to the deviation of x from the origin. Equivalently, the disturbance can be regarded as a wideband random perturbation of the system matrix A. D.T.

N66-29983# Joint Publications Research Service, Washington, D. C.
METHODOLOGICAL PROBLEMS OF MATHEMATICAL MODELING IN NATURAL SCIENCE
I. A. Akchurin, M. F. Vedenov, and Yu. V. Sachkov 30 Jun. 1966 21 p Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 4, 1966 p 64–75
(JPRS-36287; TT-66-32719) CFSTI: $1.00

A brief philosophical and historical account is presented of the application of mathematics to the physical and biological sciences. It is shown how the development of the natural sciences is primarily dependent upon the prior development of new forms of mathematics. For example, before relativity physics and quantum mechanics could be adequately expressed, the development of non-Euclidean forms of plane geometry was necessary. In addition, the proposition is advanced and discussed that the mathematization of the biological sciences will ultimately depend on the development of cybernetics as a new form and means of mathematical expression. D.T.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-28421# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF THE STATISTICAL CHARACTERISTICS OF THE SPATIAL STRUCTURE OF CLOUD FIELDS FROM AERIAL PHOTOGRAPHS
L. G. Istomina *In its* Recent Studies in Meteorology and Oceanog. 3 Jun. 1966 p 1–13 refs (See N66-28420 16-13)
CFSTI: $2.00

Discussed is a statistical analysis of cloud field photographs taken by aircraft to obtain the spatial distribution of several cloud brightness fluctuation values. Histograms of the differential distribution of the brightness value fluctuation probabilities were constructed for all cloud types investigated and it was clearly shown that cumulus and stratus clouds were distinguishable on the basis of dispersions and the mean size of their inhomogeneities. G.G.

N66-28486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LENINGRAD. MAIN GEOPHYSICAL OBSERVATORY. TRANSACTIONS
3 Dec. 1965 216 p refs Transl. into ENGLISH from the publ. "Trudy Glavnoy Geofizicheskoy Observatorii" Leningrad, Gidrometeorol. Izd. 1963 p 1–147
(FTD-MT-64-123; AD-628789) CFSTI: HC $19.70/MF $1.25

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1. PRELIMINARY RESULTS OF TEST OF AGEOSTROPHIC SCHEME OF PRECOMPUTATION OF FIELDS OF WIND, TEMPERATURE AND VERTICAL CURRENTS K. V. Pyatygina, E. A. Fedorova, and V. G. Blazhevich p 1–15 refs (See N66-28487 16-20)

2. EXPERIMENT OF FORECAST OF FIELDS OF PRESSURE, TEMPERATURE AND VERTICAL CURRENTS IN THE LOWER STRATOSPHERE A. S. Dubov and A. A. Kobyakova p 16–27 refs (See N66-28488 16-20)

3. ON FORECAST IN REGIONS OF FRONTAL ALTITUDE ZONE IN STRATOSPHERE A. S. Dubov p 28–33 refs (See N66-28489 16-20)

4. ON THE CONNECTION BETWEEN CHANGES OF GROUND PRESSURE AND HEIGHTS OF ISOBARIC SURFACES OF THE LOWER TROPOSPHERE V. M. Titov p 34–44 refs (See N66-28490 16-20)

5. SOLUTION OF EQUATIONS OF ATMOSPHERIC DYNAMICS IN THE USE OF REGULARITIES OF STRUCTURE OF METEOROLOGICAL FIELDS FOR THE PURPOSE OF SHORT-TERM WEATHER FORECAST M. I. Yudin p 45–65 refs (See N66-28491 16-20)

6. DETERMINATION OF VERTICAL SPEEDS FROM EQUATIONS OF ATMOSPHERIC DYNAMICS K. V. Pyatygina p 66–124 refs (See N66-28492 16-20)

7. CHANGE OF AIR TEMPERATURE IN THE 500-200-MB LAYER N. I. Yakovleva p 125–136 refs (See N66-28493 16-20)

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9. ON THE APPLICATION OF UNIVERSAL DIGITAL COMPUTERS FOR INVESTIGATION OF STATISTICAL STRUCTURE OF METEOROLOGICAL FIELDS L. S. Gandin, V. P. Meleshko, and A. V. Meshcherskaya p 148–171 refs (See N66-28495 16-20)

10. METHOD OF CALCULATION OF NORMS OF WIND IN THE MIDDLE TROPOSPHERE Ye. I. Bagrova and L. S. Gandin p 172–182 refs (See N66-28496 16-20)

11. INVESTIGATION OF STABILITY BY INITIAL DATA OF SOLUTION OF THE FINITE-DIFFERENCE EQUATION OF VORTEX OF BAROTROPIC MODEL I. L. Vulis p 183–193 refs (See N66-28497 16-20)

N66-28487# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRELIMINARY RESULTS OF TEST OF AGEOSTROPHIC SCHEME OF PRECOMPUTATION OF FIELDS OF WIND, TEMPERATURE AND VERTICAL CURRENTS

K. V. Pyatygina, E. A. Fedorova, and V. G. Blazhevich *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 1–15 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Preliminary results of the calculating scheme on the basis of components of ageostrophic wind and vertical currents produced precomputation of fields of wind and temperature. The scheme is realized on BESM-2 [high-speed electronic computer]. Tests are performed for three cases. The grid is triangular with spacing approximately equal to 330 km. Author

N66-28488# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENT OF FORECAST OF FIELDS OF PRESSURE, TEMPERATURE AND VERTICAL CURRENTS IN THE LOWER STRATOSPHERE

A. S. Dubov and A. A. Kobyakova *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 16–27 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Results are analyzed of 13 24-hour and two-day forecasts of fields of geopotential and temperature for a level of 200 mb by a two-dimensional (monolevel) baroclinic quasi-geostrophic model. Success of temperature forecast is noted, especially for two days. Correlation of fields of vertical speeds, calculated for the same period with daily and two-day time advance, did not reveal a connection among these fields, which attests to the unreliability of precomputation of this meteorological element for 48 hours. The possible causes of errors are analyzed; in particular, there is revealed a good connection of fields of geopotential forecast errors with regions where the surface 200 mb is located in the troposphere. Author

N66-28489# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON FORECAST IN REGIONS OF FRONTAL ALTITUDE ZONE IN STRATOSPHERE

A. S. Dubov *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 28–33 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Improved two-dimensional forecast equations for conditions of the lower stratosphere within the limits of geostrophic and adiabatic approximation are presented. Author

N66-28490# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE CONNECTION BETWEEN CHANGES OF GROUND PRESSURE AND HEIGHTS OF ISOBARIC SURFACES OF THE LOWER TROPOSPHERE

V. M. Titov *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 34–44 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Coefficients of multiple regressions are calculated, establishing a relationship between changes in time of ground pressure and heights of isobaric surfaces of 850 and 500 mb. Calculations are conducted for one- and two-day changes on data of mainland and oceanic stations. Author

N66-28491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLUTION OF EQUATIONS OF ATMOSPHERIC DYNAMICS IN THE USE OF REGULARITIES OF STRUCTURE OF METEOROLOGICAL FIELDS FOR THE PURPOSE OF SHORT-TERM WEATHER FORECAST

M. I. Yudin *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 45–65 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

In connection with the development work on numerical forecast of an ageostrophic model, it is recognized expedient to publish the first work of this trend of investigations. In it are revealed the equations of the model and a solution is offered to the spatial problem of changes of meteorological elements by the method of half-lines. No changes connected with subsequent works were introduced into the manuscript. Author

N66-28492# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF VERTICAL SPEEDS FROM EQUATIONS OF ATMOSPHERIC DYNAMICS

K. V. Pyatygina *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 66–124 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Calculation of vertical speeds by data of fields of pressure and temperature in an initial moment of time is presented. A test of the shown method is performed by comparison of fields of vertical speeds with zones of precipitation and cloudiness, and also with fields of vertical speeds calculated from the equation of vorticity. In determination of vertical speeds from the equation of vorticity there is developed a more accurate calculation of trajectories of air particles. Author

N66-28493# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGE OF AIR TEMPERATURE IN THE 500–200 MB LAYER

N. I. Yakovleva *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 125–136 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

In data of maps AT_{500}, AT_{300}, and AT_{200} are appraisals of individual members of the equation of heat flow. On temperature change of a volume of air moving along a trajectory on an isobaric surface, vertical currents shown an essential influence. Tentative appraisals of nonadiabatic factors show that their calculation is also very desirable. Author

N66-28494# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON METHODS OF DESCRIPTION OF THE ANOMALIES OF CLOUDINESS, SNOW COVER, AND RADIATION FLOWS

V. B. Afanas'yeva and N. P. Bogdanova-Esakova *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 137–147 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

Methodology is developed and mean ten-day maps are constructed of cloudiness, snow cover, and radiation balance for individual months for the territory of USSR. Author

N66-28495# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE APPLICATION OF UNIVERSAL DIGITAL COMPUTERS FOR INVESTIGATION OF STATISTICAL STRUCTURE OF METEOROLOGICAL FIELDS

L. S. Gandin, V. P. Meleshko, and A. V. Meshcherskaya *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 148–171 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

The methodology of calculating macroscale correlated and structural functions of meteorological fields with the help of universal high speed computers is described in detail. Data are presented on spatial structure of pressure at sea level and dew point on the 500 mb surface. Author

N66-28496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF CALCULATION OF NORMS OF WIND IN THE MIDDLE TROPOSPHERE

Ye. I. Bagrova and L. S. Gandin *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 172–182 refs (See N66-28486 16-20) CFSTI: HC $19.70/MF $1.25

An improved method of calculating wind norms by data on norms of geopotential of isobaric surfaces is offered. Calculating formulas and tables are presented, and also some results of calculations. Author

N66-28497# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF STABILITY BY INITIAL DATA OF SOLUTION OF THE FINITE-DIFFERENCE EQUATION OF VORTEX OF BAROTROPIC MODEL

I. L. Volis *In its* Leningrad. Main Geophys. Obs. Trans. 3 Dec. 1965 p 183–193 refs (See N66-28486 16-20)

Stability is investigated on the basis of initial data of a finite-difference scheme for the vortex equation. It appears that stability in the case of application of a square grid does not depend on the turn of axes of coordinates and is determined only by the relationship of point scales of the first and second circles. Author

N66-28499# Joint Publications Research Service, Washington, D. C.

STUDIES IN METEOROLOGY AND HYDROLOGY (APRIL 1966)

3 Jun. 1966 103 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 4, 1966 p 3–11; 26–29; 29–32; 41–44; 45–48; 53–54

(JPRS-35828; TT-66-32262) CFSTI: $3.00

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9. REVIEW OF THE BOOK ELECTRICITY IN THE FREE ATMOSPHERE BY I. M. IMYANITOV AND YE. V. CHUBARINA L. G. Kachurin and V. M. Muchnik p 60–65

10. LITERATURE ON METEOROLOGY AND HYDROLOGY FOR 1965 p 66–77 refs

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N66-28500# Joint Publications Research Service, Washington, D. C.

ENERGY SPECTRA OF WIND VELOCITY FLUCTUATIONS IN THE FREE ATMOSPHERE

N. Z. Pinus *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 1–13 refs (See N66-28499 16-20) CFSTI: $3.00

Turbulent wind spectra over a wide range of frequencies were studied by computing the autocorrelation and spectral density functions from a series of rawin observations and aircraft measurements by navigation Doppler system and thermoanemometer. Energy fluctuation spectra of the horizontal components of wind velocities at the 500-, 300-, and 200-mb levels showed that the energy in the region of the micrometeorological maximum (less than 1 m^2/sec^2) was less than the energy of the synoptic maximum (to several hundred m^2/sec^2). In an atmosphere where no direct influence was exerted by the earth's surface, a clearly expressed micrometeorological maximum was not always observed. G.G.

N66-28501# Joint Publications Research Service, Washington, D. C.

FORECASTING THE MEAN VALUE OF INDICES OF ATMOSPHERIC CIRCULATION FOR A NATURAL SYNOPTIC PERIOD

M. N. Fedulova *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 14–19 refs (See N66-28499 16-20) CFSTI: $3.00

Numerical forecasting of the mean values of atmospheric circulation indices for a natural synoptic period was studied. Regression equations were derived to relate zonal and meridional circulation indices with the tendency of the entire natural synoptic period. This synoptic-statistical forecast method showed less error for all forms of circulation, except easterly, than the error of the initial forecast. G.G.

N66-28502# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE FLOOD PEAK TRAVEL TIME IN THE RIVERS OF PRIMORSKIY KRAY

N. D. Shtefan *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 20–26 refs (See N66-28499 16-20) CFSTI: $3.00

A formula for computing flood peak travel time on the rivers of Primorskiy Kray was obtained by using hydrometric data corrected for flood travel times between hydrometric stations. The ratio L_{fl}/lg_F was used to describe the river flood plains, where L_{fl} was the mean width of the flood plain to the hydrometric station for which the computations were made, and where F was the area of the drainage basin to the hydrometric station. The equation for the relationship was: $V_{com}/V_{act}=1.55\ L_{fl}/lg_F+0.5$, where V_{com} is the computed velocity, and V_{act} is the actual velocity. Mean velocity and maximum discharge values at the closing station corresponded well to the mean passage velocity of the flood peak between hydrometric stations. G.G.

N66-28503# Joint Publications Research Service, Washington, D. C.

INTERPRETATION AND METEOROLOGICAL USE OF SATELLITE INFORMATION

I. P. Vetlov *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 41–49 refs (See N66-28499 16-20) CFSTI: $3.00

Interpretive studies for meteorological use of satellite information are briefly reviewed. Described are the following analytical problems of televised cloud cover images: synoptic reconstruction using cloud cover fields as indicated by satellite data; weather forecasting by comparison of surface and satellite data on cloud cover structures; interpretation of satellite radiation measurements to obtain angular and spectral distributions of reflected radiation; temperature determination of the radiating surface and the height of the upper cloud boundary; and selection of parameters to identify cloud cover anomalies for long-range forecasting. G.G.

N66-28504# Joint Publications Research Service, Washington, D. C.

USE OF TELEVISION OBSERVATIONS OF METEOROLOGICAL SATELLITES IN SYNOPTIC ANALYSIS AT THE CENTRAL INSTITUTE OF FORECASTS

L. S. Minina *In its* Studies in Meteorol. and Hydrol. (Apr. 1966) 3 Jun. 1966 p 50–56 refs (See N66-28499 16-20) CFSTI: $3.00

Televised images of cloud cover observations by meteorological satellites were used to compile cloud analysis maps for day-to-day information to local weather services. The following interpretations of satellite cloud observations were made: (1) The presence of a focused cloud eddy was evidence of a cyclonic center at some level; (2) in cyclones of temperate latitudes the center of the vortical cloud cover structure coincided either with the center of the cyclone at the earth's surface or with its center at some heights; (3) cloud eddies of small size, observed at great heights in the troposphere, were usually located in a high-level frontal zone, mostly on the left side of a jet stream; (4) the vortical structure center of the cloud cover coincided with the cyclone center in tropical regions; (5) banked or banded structures of cumulus clouds in the rear of cyclones were used to describe atmospheric stratification and wind fields. Comparison of satellite and surface cloud cover observations revealed satisfactory agreement. G.G.

N66-28651# Joint Publications Research Service, Washington, D. C.

COMPUTER ANALYSIS OF HYDROMETEOROLOGICAL INFORMATION ON SHIPBOARD

A. N. Shekhtman *In its* Recent Develop. in Soviet Oceanog. 17 Feb. 1966 p 33–38 refs (See N66-28646 16-13) CFSTI: $2.00

The use of punch cards for data storage for hydrometeorological and aerological data taken on research scientific vessels is discussed. The actual punching of cards on board, for future processing on land, is described. It was considered that additional personnel were not needed, and a manual puncher was suitable. N.E.H.

N66-28653# National Severe Storms Lab., Norman, Okla.

PROBING AIR MOTION BY DOPPLER ANALYSIS OF RADAR CLEAR AIR RETURNS

Roger M. Lhermitte Washington, May 1966 46 p refs (TN-46-NSSL-26)

A Doppler radar was used to probe the motion of invisible targets usually referred to as angles. The large density of targets detected on certain days suggests the presence of a dense atmospheric plankton drifting with the air. Uniform motion for all the targets in the area surveyed by the radar beam is confirmed by the systematic pattern of target radial motions as a function of radar beam azimuth. Target horizontal motion direction and speed are derived from the radial velocity-azimuth patterns and interpreted as horizontal wind. The small vertical motion of targets is also estimated from the data. This technique is applied to the analysis of wind variance and the study of a low-level jet. Author

N66-28860# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MAIN GEOPHYSICAL OBSERVATORY Selected Articles 25 Oct. 1965 20 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 153, 1964 p 11–17; 75–77 (FTD-TT-65-551/1+2; TT-66-60582; AD-628308) CFSTI: HC $1.60/MF $0.50

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1. THE RELATIONSHIP BETWEEN THE HEIGHT OF CLOUD BASES AND VISUAL RANGE AT THE GROUND N. S. Bozhevikov p 1–9 refs (See N66-28861 16-20)

2. AUTOMATIC FILTER SUBSTITUTION TO RECORD PRONOUNCED CHANGES IN LUMINOUS FLUX O. I. Kasatkina (Golikova) and L. B. Krasil'shchikov p 10–13 (See N66-28862 16-23)

N66-28861# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE RELATIONSHIP BETWEEN THE HEIGHT OF CLOUD BASES AND VISUAL RANGE AT THE GROUND

N. S. Bozhevikov *In its* Main Geophys. Obs. 25 Oct. 1965 p 1–9 refs (See N66-28860 16-20) CFSTI: HC $1.60/MF $0.50

The relationship is examined between the height of cloud bases measured by triangulation with a Bozhevikov cloud-height indicator and horizontal visibility determined on the basis of prominent dark objects against the sky at the horizon. A tendency toward reduced horizontal visibility is noted with a drop in the height of the cloud bases. Author

N66-29069*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
TIROS VII INFRARED RADIATION COVERAGE OF THE 1963 ATLANTIC HURRICANE SEASON WITH SUPPORTING TELEVISION AND CONVENTIONAL METEOROLOGICAL DATA
Lewis J. Allison and Harold P. Thompson Washington, NASA, Jun. 1966 52 p refs
(NASA-TN-D-3127) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Eight tropical cyclones of the 1963 North Atlantic hurricane season were studied using Tiros VII Channel 2 (8–12μ) radiation data. Seventeen computer-produced radiation charts were analyzed in order to delineate the three dimensional cloud structure over these storms. Time cross-sections were drawn over Hurricanes Cindy and Edith in order to relate the warm core development and upper-level outflow of the storms with their respective cloud canopies, as shown by the radiation data. Tiros VI and VII television pictures and nephanalyses, aerial reconnaissance weather reports, radar photographs, radiosonde data, and conventional synoptic analyses were used to complement the Tiros VII radiation data. An attempt was made to correlate minimum equivalent blackbody temperatures T_{BB} measured by the satellite over the tropical cyclones with maximum observed surface wind speeds. However, the minimum T_{BB} values were found to vary from 205° to 220° K in several stages of hurricane development, and no significant relationship between tropical cyclone intensity and cloud top heights could be found from the limited data sample available. Author

N66-29247# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT: ATHENA FLIGHT NO. 039 (31 MARCH 1966) AND ATHENA FLIGHT NO. 040 (31 MARCH 1966)
Harold M. Richart Fort Monmouth, N. J., Army Electron. Command, May 1966 66 p refs
(DR-10; AD-632515) CFSTI: HC $3.00/MF $0.75

Meteorological data gathered for the launching of Athena Flight Number 039, Vehicle No. B-009 and Athena Flight Number 040, Vehicle No. D-019 are presented for the Air Force Ballistic Missile Reentry Systems Office and for ballistic studies. The data are presented in tabular form. Author (TAB)

N66-29251# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT: AEROBEE AF 3.524 (30 MARCH 1966)
Marjorie Mc Lardie Hoidale Fort Monmouth, N. J., Army Electron. Command, Apr. 1966 31 p refs
(DR-9; AD-632348) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of Aerobee AF 3.524 are presented for the Air Force Cambridge Research Center and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

N66-29252# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT: AEROBEE NASA 4.143 NA (14 APRIL 1966) AND AEROBEE NASA 4.24 US (14 APRIL 1966)
Marjorie Mc Lardie Hoidale Fort Monmouth, N. J., Army Electron. Command, May 1966 35 p refs
(DR-11; AD-632349) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of Aerobee NASA 4.143 NA and Aerobee NASA 4.24 US are presented for the National Aeronautics and Space Administration, the University of Colorado, and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

N66-29264# Emmanuel Coll., Boston, Mass. Oriental Science Library.
A PRELIMINARY STUDY OF THE CHARACTERISTICS AND EVOLUTION OF THE MEAN MONTHLY CIRCULATION AT THE 500-MB LEVEL OVER THE NORTHERN HEMISPHERE. (II) ULTRA-LONG WAVES
Shao-wu Wang Bedford, Mass., AFCRL, Mar. 1966 28 p refs Transl. into ENGLISH from Acta Met. Sinica (Peking), v. 34, no. 3, 1964 p 316–328
(Contract AF 19(628)-5073)
(EMM-65-18; AD-632407) CFSTI: HC $2.00/MF $0.50

The conclusions are as follows: (1) There are pronounced seasonal patterns in the (relative) amplitudes of the first and third harmonics with a strong negative correlation between the two. The (relative) amplitudes of both the first and third harmonics at 55°N are negatively correlated to their counter parts at 35°N. No significant seasonal variation is indicated for the relative amplitude of the second harmonic. (2) The change of the phase angle shows a regular seasonal course at 55°N except for the second harmonic. (3) The variation of the spectrum shows that the seasonal variation is different from year to year but the general trend is the same for all years. (4) The characteristics of the spectrum of transitional seasons are clearly distinct from those of summer and winter and therefore the natural synoptic seasons may be clearly defined. The beginning and ending as well as the length and character of the seasons vary from one year to another. (5) The weather anomaly in China has a close relationship with the pattern of ultra-long waves in the northern hemisphere. This may be shown by the examples of July 1954 and 1959 and February 1957 and 1960. Author (TAB)

N66-29302*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.51 UG (23 MAY 1966) Meteorological Data Report
Gordon L. Dunaway Ft. Monmouth, N. J., Army Electron. Lab., Jun. 1966 32 p refs
(NASA-CR-75855; DR-36) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data gathered for the launching of Aerobee NASA 4.51 UG are presented for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author

N66-29318# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA FROM JOKIOINEN AND SODANKYLAE OBSERVATORIES, 1962 [JOKIOSTEN JA SODANKYLAEN OBSERVATORIOIDEN ILMASTOHAVAINNOT, 1962]
Jan. 1965 52 p refs In FINISH and ENGLISH *Its* Meteorol. Yearbook, Vol. 62, Pt. 1B
CFSTI: HC $3.00/MF $0.50

This volume contains the results of observations made by the meteorological observatories of Jokioinen and Sodankylä in 1962. It gives the values obtained from recordings of atmospheric pressure, temperature, relative humidity, wind

direction and speed at even hours, also the amount of sunshine and cloud, including cloud formation and height, hydrometeors observed with time of appearance, visibility, and precipitations. Author

N66-29325# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA FROM JOKIOINEN AND SODANKYLAE OBSERVATORIES, 1963 [JOKIOISTEN JA SODANKYLAEN OBSERVATORIOIDEN ILMASTOHAYAINNOT, 1963]
Oct. 1965 55 p refs In FINNISH and ENGLISH *Its* Meteorol. Yearbook, Vol. 63, Pt. 1B
CFSTI: HC $3.00/MF $0.50

This volume contains the results of observations made by the meteorological observatories of Jokioinen and Sodankylä in 1963. It gives the values obtained from recordings of atmospheric pressure, temperature, relative humidity, wind direction and speed at even hours, also the amount of sunshine and cloud, including cloud formation and height, hydrometeors observed with time of appearance, visibility, and precipitations. Author

N66-29445# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL DATA REPORT, ATHENA FLIGHT NUMBER 015 (16 JULY 1965)
Harold M. Richart Aug. 1965 66 p refs
(ERDA-332; AD-467707)

Meteorological ballistic data are tabulated for the launching of Athena flight number 015 vehicle B-003. Trajectory calculations and recommended launcher settings are given. The real-time system used for impact predictions consists of a 500-foot meteorological tower, three manually-operated theodolites, a rawin wind-measuring system, a Loki rocket for measuring winds above the rawin level, and a high speed digital computer. Upper air data and mandatory levels are tabulated for various MST release times, and velocity vector data for the flight are graphed. M.W.R.

N66-29499# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA, 1963 [ILMASTOHAVAINNOT 1963]
1965 83 p refs In FINNISH and ENGLISH *Its* Meteorol. Yearbook, Vol. 63, Pt. 1a
CFSTI: HC $3.00/MF $0.75

Monthly and yearly summaries of meteorological observations from various weather stations in Finland are presented. The data includes maximum and minimum temperatures, precipitation recorded, air pressures, relative humidity, cloud cover, and other weather phenomena. H.S.W.

N66-29540# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA, 1959 [ILMASTOHAVAINNOT, 1959]
1965 94 p In ENGLISH and FINNISH *Its* Meteorol. Yearbook, Vol. 59, Pt. 1a
CFSTI: HC $3.00/MF $0.75

Tabulated climatological data for Finland for the year 1959 are presented. Included are daily, monthly, and yearly observations of temperature, precipitation, snow depth, air pressure, humidity, wind direction and speed, state of ground surface, cloudiness, visibility, and weather phenomena. Also given are a map and a list of the observation stations. R.N.A.

N66-29641# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA, 1955 [ILMASTOHAVAINNOT, 1955]
1955 84 p In ENGLISH and FINNISH *Its* Meteorol. Yearbook, Vol. 55, Pt. 1a
CFSTI: HC $3.00/MF $0.75

Tabulated climatological data for Finland are presented for the year 1955. Included are a map of meteorological stations, a list of these stations, daily observations, monthly and annual summaries, a list of precipitation observation points, and monthly and yearly abstracts of precipitation. R.N.A.

N66-29676# American Meteorological Society, Boston, Mass.
SOME RESULTS OF RADAR OBSERVATIONS OF THE DEVELOPMENT OF CU CONG CLOUDS AND THE RESULTS OF MODIFICATION [NEKOTORYE REZUL'TATY RADIOLOKATSIONNYKH NABLIUDENNI EVOLIUTSII MOSCHNO-KUCHEVYKH OBLAKOV I REZUL'TATOV VOZDEISTVIIA]
A. M. Borovikov, V. V. Kostarev, and A. B. Shupiatskii Bedford, Mass., AFCRL, Mar. 1966 27 p ref Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 24-40
(Contract AF 19(628)-3880)
(T-R-510; AD-631966) CFSTI: HC $2.00/MF $0.50

The apparatus and methods for radar observations of the development of cumulus congestus and cumulonimbus clouds are discussed. Analysis of the observational data provided preliminary indications of the hail content of cumulonimbus clouds, and some criteria are proposed for determining the effect of artificial modification aimed at preventing hail damage. Author (TAB)

N66-29678# American Meteorological Society, Boston, Mass.
ACCURACY OF DETERMINING CLOUD BOUNDARIES BY RADAR [TOCHNOST' IZMERENIIA GRANITS OBLAKOV RADIOLOKATSIONNYM METODOM]
G. I. Kulikova, G. T. Nikandrova, and V. A. Petrushevskii Bedford, Mass., AFCRL, Feb. 1966 18 p refs Transl. into ENGLISH from Tr. Geofiz. Observ. (Leningrad), no. 173, 1965 p 9-18
(Contract AF 19(628)-3880)
(T-R-531; AD-631968) CFSTI: HC $1.00/MF $0.50

The fields of cloud heights as measured by radar and by aircraft are compared, and the errors in the determination of cloud boundaries by radar are examined. The accuracy of the determination of cloud boundaries is evaluated on the basis of experimental data. Author

N66-29679# Meteorology Research, Inc., Altadena, Calif.
ANALYSIS OF FLAGSTAFF DATA Final Report, 1 Nov. 1964-31 Dec. 1965
Paul B. Mac Cready, Jr., Theodore B. Smith, and Alan I. Weinstein Apr. 1966 48 p refs *Its* Rept.-4
(Contract DA-28-043-AMC-00406(E))
(ECOM-00406-F; AD-632016) CFSTI: HC $2.00/MF $0.50

The continuous particle collector proved capable of yielding quantitative droplet distribution data and qualitative information on larger hydrometeors. In the Flagstaff convective clouds the droplet concentrations were high, 600 to 2000 per cm^3 near cloud base, and some correlation was noted versus upcurrent strength. Drizzle-size drops grew in the cloud cores by coalescence, starting from large

droplets (substantially larger than the small-droplet population) which were present even at cloud base in concentrations of 20 per liter. A possible source of such large droplets is considered to be giant salt particles, perhaps augmented from a maritime condensation nuclei distribution by coalescence effects in previous clouds. The growth rate of droplets on such nuclei is calculated for several parcel ascent rates. Graupel was encountered regularly at −5 and −6°C, mostly outside cell cores, suggesting the rapid freezing and riming of the drizzle-size drops. The principles of cloud modification techniques are considered. They show that the transistory seeding methods used in 1962 and 1963 would not be expected to show large effects, and so techniques are suggested which consider diffusion effects and cloud seedability (especially buoyancy aspects). The quantitative basis is presented for buoyancy increases from seeding, considering all vapor, liquid, and solid water phases. The convective wake phenomenon is reexamined, and a new concept for its occurrence is introduced: surface convergence and conditional instability released by the generation of a longitudinal vortex pair immediately downwind of the isolated peaks. Author (TAB)

N66-29742*# RAND Corp., Santa Monica, Calif.
PROBABILISTIC DYNAMICS OF A GLOBAL HORIZONTAL SOUNDING SYSTEM
R. R. Rapp Jun. 1966 36 p refs
(Contract NASr-21(07))
(NASA-CR-76000; RM-5018-NASA) CFSTI: HC $2.00/MF $0.50 CSCL 04B

A method is developed for treating the position and motion of large numbers of constant-level balloons in a probabilistic fashion. The general-circulation model of Mintz is used to generate estimates of the motion of 1000 balloons at approximately the 400-mb level for a period of 45 days. The location of the balloons each day is expressed as the probability of being located in one of 34 possible regions of the earth. The motions are specified by the transition probabilities from one region to another in a 24-hour period. The degree to which the probabilities computed from the general circulation can be expected to match probabilities computed from real balloon trajectories is discussed. It is then shown how probabilities such as these, but more appropriate to the real atmosphere, could be used to show how balloons would be distributed and how reasonable variants of the expected distribution could be computed. It is suggested that the exercise of this type of probabilistic model could lead to a rational strategy for launching balloons to attain an optimum distribution of balloons over the globe. Author

N66-29745*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.92 (20 MAY 1966) Meteorological Data Report
Gordon L. Dunaway Ft. Monmouth, N. J., Army Electron. Command, Jun. 1966 34 p refs
(NASA-CR-76049; DR-35) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data gathered for the launching of Aerobee NASA 4.92 are presented for the National Aeronautics and Space Administration and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author

N66-29840# American Meteorological Society, Boston, Mass.
EVALUATION OF ARTIFICIAL-MODIFICATION EFFICIENCY FROM THE POLARIZATION CHARACTERISTICS OF THE ECHO SIGNAL [OTSENKA EFFEKTIVNOSTI ISKUSSTVENNYKH VOZDEISTVII PO POLARIZATSIONNYM KHARAKTERISTIKAM EKHO-SIGNALA]
S. P. Morgunov and A. B. Shupiatskii Bedford, Mass., AFCRL, Jan. 1966 13 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 49–54
(Contract AF 19(628)-3880)
(T-R-514; TT-66-61156; AD-631964) CFSTI: HC $1.00/MF $0.50

The use of the polarization method is discussed as one of the criteria for evaluating the effectiveness of (cloud) modification. There is a brief outline of a method suitable for a radar with one movable antenna, and some results of measurements made during artificial modifications are given. Author (TAB)

N66-29841# American Meteorological Society, Boston, Mass.
FORECASTING THE NOCTURNAL TEMPERATURE VARIATION OF THE ATMOSPHERIC SURFACE BOUNDARY LAYER [K PROGNOZU NOCHNOGO IZMENEVIIA TEMPERATURY PRIZEMNOGO SLOIA VOZDUKHA]
M. E. Berliand and V. P. Gracheva Bedford, Mass., AFCRL, Jan. 1966 23 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Obs. (Leningrad), no. 127, 1962 p 35–47
(Contract AF 19(628)-3880)
(T-R-489; TT-66-61157; AD-631965) CFSTI: HC $1.00/MF $0.50

It is proposed that the method of forecasting the nocturnal temperature variation of the atmospheric surface boundary layer be refined by taking into account the prior temperature variation. The examination first covers the general case, where the prior temperature variation at the level of the instrument shelter is given as an arbitrary function of time in agreement with observational data. Next, it is shown that for practical purposes, the representation of the prior temperature variation can be confined to a periodic function, and a solution to the problem is given for this case. The resulting solution is taken as the basis for a system of calculation that is sufficiently convenient for operational use in the weather station network and at the weather office. Author (TAB)

N66-29898# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
NIKE–APACHE STV (SR-026) (29 MARCH 1966) Meteorological Data Report
Gordon L. Dunaway Apr. 1966 21 p
(DR-8; AD-632347) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Nike–Apache STV (SR-026), are presented for the Ballistic Systems Division, U. S. Air Force, and for ballistic studies. The meteorological data and resulting ballistic data appear in tabular form. Author (TAB)

N66-29977*# Stanford Research Inst., Menlo Park, Calif.
PERFORMANCE SPECIFICATIONS FOR A METEOROLOGICAL SATELLITE LIDAR Final Report
W. E. Evans, E. J. Wiegman, W. Viezee, and M. G. H. Ligda Jun. 1966 190 p refs
(Contract NASr-49(22))
(NASA-CR-76087) CFSTI: HC $5.00/MF $1.25 CSCL 04B

Numerous suggestions have been made regarding measurements of meteorological significance which might be made with a laser radar (lidar) carried in a satellite. In this study a wide variety of possibilities is examined, and it is concluded that the most important thing that can be done with reasonable amounts of power is to provide routine height and density data on cirrus cloud. Cloud-top elevations of lower cloud would also be determined. Calculations, supported by experimental backscatter measurements made with a ground-based pulsed ruby lidar, show that it should be barely possible to measure low-density cirrus cloud at night from a 1000 to 1500 km satellite using a radiated energy of one joule per sounding and a receiving aperture of one square meter.

Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-28752*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

SPACE NAVIGATION GUIDANCE AND CONTROL, VOLUME 1

Jun. 1965 233 p refs

(Contract NAS9-4065)

(NASA-CR-75543; R-500, Vol. 1) CFSTI: HC $6.00/MF $1.25 CSCL 17G

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N66-28753*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

GUIDANCE—BASIC PRINCIPLES

C. Stark Draper and Walter Wrigley *In its* Space Navigation Guidance and Control, Vol. 1 Jun. 1965 73 p refs (See N66-28752 16-21) CFSTI: HC $6.00/MF $1.25

The historical background of the fundamental problems of guidance and navigation is presented, and the basic principles, requirements, mechanization features, and natural performance limitations of components and systems to meet military needs are discussed. Representative numerical values for typical cases are cited. The following basic guidance principles are included: guidance problems, geometrical aspects, functional requirements of systems and their components, components technology, gyroscope units for guidance system reference coordinates, gyroscope unit applications, specific force receivers, and inertial systems.

L.E.W.

N66-28754*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

THE NAVIGATION, GUIDANCE AND CONTROL OF A MANNED LUNAR LANDING

David G. Hoag *In its* Space Navigation Guidance and Control, Vol. 1 Jun. 1965 90 p refs (See N66-28752 16-21) CFSTI: HC $6.00/MF $1.25

Guidance, navigation, and control problems of the Apollo manned lunar landing mission are discussed in relation to the basic philosophy underlying the approach to the Apollo task. Spacecraft rotational and translational management terms are defined, and their relation to free-fall and thrusting accelerated conditions are discussed. The overall Apollo mission is summarized, and the various phases are depicted and described. The sensors and data processors for guidance, navigation, and control on the Apollo are presented including the inertial measurement system, inertial system alignment, optical measurement system, and onboard computer. A series of diagrams illustrates the equipment involved, its installation, and the information flow. Safety aspects considered include the following: abort trajectories, control of propulsion failure backups, failure detection and alarm, navigation redundancy, and guidance and control backup.

L.E.W.

N66-28755*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

EXPLICIT AND UNIFIED METHODS OF SPACECRAFT GUIDANCE

Richard H. Battin *In its* Space Navigation Guidance and Control, Vol. 1 Jun. 1965 47 p refs (See N66-28752 16-21) CFSTI: HC $6.00/MF $1.25

Some of the current techniques for solving the guidance problem are reviewed, emphasizing the methods which are consistent with the explicit and unified philosophy of design. Basic computations are given and equations are formulated for accelerated flight navigation, coasting flight navigation, powered-flight guidance, and midcourse guidance. Incremental outputs from inertially stabilized integrating accelerometers, together with components of gravitational acceleration computed as functions of inertial position in a feedback loop, are summed to give the components of inertial velocity. The analytic foundation for performing onboard calculations for navigation and guidance is discussed, and various statistical methods of the navigation problem are compared.

L.E.W.

N66-28759*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

SPACE NAVIGATION GUIDANCE AND CONTROL, VOLUME 2

Jun. 1965 271 p refs

(Contract NAS9-4065)

(NASA-CR-75798; R-500, Vol. 2) CFSTI: HC $6.00/MF $1.50 CSCL 17G

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1. INERTIAL MEASUREMENT UNITS AND PULSE TORQUING J. E. Miller p 1–56 refs (See N66-28760 16-21)
2. OPTICAL MEASUREMENTS AND NAVIGATION PHENOMENA D. K. Koso 44 p refs (See N66-28761 16-21)
3. GUIDANCE COMPUTER DESIGN A. Hopkins 83 p refs (See N66-28762 16-08)
4. SPACE VEHICLE CONTROL SYSTEMS W. E. Vander Velde 65 p refs (See N66-28763 16-03)

N66-28760*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

INERTIAL MEASUREMENT UNITS AND PULSE TORQUING

John E. Miller *In its* Space Navigation Guidance and Control Vol. 2 Jun. 1965 p 1-56 refs (See N66-28759 16-21) CFSTI: HC $6.00/MF $1.50

The mechanization of the inertial sensor equipment of the Apollo guidance and control system, i.e., inertial measurement unit (IMU), pulsed integrating pendulous accelerometer (PIPA), and coupling data unit (CDU), is covered in detail. The Apollo IMU is a three degree of freedom gimbal system using integrating gyroscopes to detect angular deviations of the stable member with respect to inertial space, and to provide the establishment of a nonrotating member. Three accelerometers are mounted on this stable member. The gyroscopes and accelerometers are temperature controlled; the IMU provides a hermetically sealed environment containing air at atmospheric pressure. The PIPA is a single degree of freedom pendulum mounted on the stable member and is nonrotating with respect to inertial space. Dynamic operation of PIPA is illustrated by schematics, and equations are formulated. The CDU provides the junction between IMU, optics, computer, and parts of the spacecraft analog electrical interfaces. The CDU analog to digital conversion process is discussed in detail. L.E.W.

N66-28761*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

OPTICAL MEASUREMENTS AND NAVIGATION PHENOMENA

D. Alexander Koso *In its* Space Navigation Guidance and Control, Vol. 2 Jun. 1965 44 p refs (See N66-28759 16-21) CFSTI: HC $6.00/MF $1.50

Optical measurements and navigation problems during the orbital and midcourse phases of the Apollo space mission are discussed. A set of linear constant coefficient equations are formulated to define the errors in position computation of an orbiting vehicle; these motion equations are written in polar coordinates for linear approximation. A block diagram of error propagation is included, and six possible errors due to initial conditions at some time after orbital insertion are summarized. Results indicate that only range error grows with time, and that no error coupling exists between range and track errors. Onboard measurement methods during the orbital phase, e.g., known landmark bearing, unknown landmark bearing, and star occultation, are described; and optical measurements used during midcourse navigation, including star landmark angle, star horizon angle, and star occultation measurements, are depicted and discussed. The design and functions of the Apollo optical unit, which consists of a sextant, automatic star tracker and photometer, and scanning telescope, are considered. L.E.W.

N66-29197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFRARED RADIATION AND ITS APPLICATION IN ROCKETS

Chen Tei 15 Mar. 1966 9 p Transl. into ENGLISH from Tien Tzu Chi Shu (China), no. 4, 1964 p 31-33
(FTD-TT-65-926/1+2+3+4; AD-631768) CFSTI: HC $1.00/MF $0.50

A semi-technical discussion dealing with the nature of infrared radiation, infrared radar, and infrared missile guidance. TAB

N66-29217*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE HIGHLY COUPLED SYSTEM—A GENERAL APPROACH TO THE PASSIVE ATTITUDE STABILIZATION OF SPACE VEHICLES

Vernon K. Merrick and Francis J. Moran Washington, NASA, Jul. 1966 29 p refs Presented at 3d Congr. of Intern. Federation of Autom. Control, London, Jun. 1966
(NASA-TN-D-3480) CFSTI: HC $2.00/MF $0.50 CSCL 17G

Implicit in the design philosophy of most vehicle control and stabilization systems is freedom of choice to promote the types of configuration symmetry which simplify the task of mathematical analysis. Such an approach can unduly restrict the class of acceptable systems and may result in a greater than necessary mechanical complication. This report supports the above observation by showing that space vehicles having certain types of unsymmetrical mass distribution can be passively stabilized using fewer of the same components than is required with a symmetrical mass distribution. The saving is a direct result of the inertial coupling between the degrees of freedom. This coupling, when used to the best advantage, ensures mutual dependence of all the degrees of freedom and usually precludes mathematical simplification. Examples are given which show that the highly coupled system approach can be used in the design of space vehicle passive attitude stabilization systems when any of the three major ambient force fields (solar electromagnetic, earth magnetic, and gravitation) are used to provide the prime stabilizing torques. Some of the unique synthesis problems arising from the mathematical complexity are discussed. Author

N66-29289*# General Dynamics/Convair, San Diego, Calif.

FEASIBILITY STUDY AND DESIGN CONCEPT FOR THE COMPUTER-CONTROLLED LAUNCH SET

30 Aug. 1965 211 p refs
(Contract NAS3-3232)
(NASA-CR-72007; GD/C-BTD-65-127) CFSTI: HC $6.00/MF $1.25 CSCL 17G

A design concept for the computer-controlled launch set (CCLS) to check out and launch the Centaur guidance system is described. The CCLS consists of three major components: an automatic test set, which includes a high-speed low-cost general purpose digital computer, standard input/output devices, and digital-to-analog and analog-to-digital converters; a display system, which outputs alphanumeric status and control information on the face of a cathode ray tube; and the auxiliary electronics, which directly interface the test set with the guidance system. A ground computer, rather than the airborne computer, will control the tests, thereby providing automatic data reduction, increased monitoring, and more flexible control capabilities. The test concept and portions of design concept were demonstrated using an automatic pilot checkout computer. Special emphasis was placed on communication with the airborne computer and platform gimbal course alignment. Techniques and implementation of computer-controlled checkout, management plans, and the feasibility demonstration are described in detail. L.E.W.

N66-29320# Royal Aircraft Establishment, Farnborough (England).

FIELD TRIALS OF A FREQUENCY MODULATED STAR SENSOR

P. Haskell Mar. 1966 45 p refs
(RAE-TR-66066) CFSTI: HC $2.00/MF $0.50

An experimental version of a f.m. star sensor intended for attitude control of satellites was subjected to a series of tests under laboratory and field conditions, in order to assess the accuracy of predictions of its performance, and so give confidence in extrapolations of the predictions to space conditions. Laboratory measurements showed that the equivalent

noise angle on the sensor output was very low (≤1.2 arc sec) for simulated stars of +2 magnitude and brighter on an S11 magnitude scale, based on theoretical predictions of stellar signal currents. Field measurements of signal current due to real stars agreed with predicted values to within a nearly constant factor of about 2 and the equivalent noise angle agreed with the laboratory measurements within a factor of about 3 under the best observing conditions obtained during the trials. This report describes the equipment, facilities and method of measurement, and concludes with a discussion of the results and sources of error. Author

N66-29321# Royal Aircraft Establishment, Farnborough (England).
DEVELOPMENT OF A STAR SENSOR FOR SATELLITE ATTITUDE CONTROL
G. W. Brown Feb. 1966 21 p Presented at "Optics in Space" Conf., Southampton, England, 27–30 Sep. 1965 Sponsored by the Optical Group of the Inst. of Phys. and the Phys. Soc.
(RAE-TR-66033) CFSTI: HC $1.00/MF $0.50

This paper describes the early stages in the development of a star sensor which is designed to drive gas jets or reaction wheels to counterbalance disturbing torques and so stabilize the attitude of a satellite in space axes. Theoretical and practical results leading to the choice of a frequency modulated system are given. In laboratory tests an experimental sensor of this type, with an optical field of 1/2 degree, has produced an output voltage that is roughly proportional to misalignment angle with less than one arcsecond equivalent rms noise in a bandwidth of 0.5 cps when sensing a +2 magnitude star. Almost as good a result has been achieved in field trials at the Royal Observatory at Herstmonceux. Author

N66-29391*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME NOTES ON METHODS OF ASSESSING VERTICAL SEPARATION STANDARDS
William Gracey [1965] 17 p refs Presented at the 12th ALPA Air Safety Forum of the Airline Pilots Assoc., Des Plaines, Ill., 5–6 Oct. 1965
(NASA-TM-X-56784) CFSTI: HC $1.00/MF $0.50 CSCL 17G

Errors in methods used to evaluate vertical separation standards are defined, and the known magnitudes of these errors for the altitude range of 30,000 to 40,000 feet are indicated. Methods considered are: vertical separation-loss, collision probability, error summation, and flight operation. Data are presented for routine airline operations of piston and turboprop aircraft and turbojets. Static-pressure errors and flight technical errors are discussed with respect to assigned altitude separations. Collision probabilities are computed, and the importance of reducing the overall altimetry to a value less than one-half the separation minimum is stressed. An assessment of vertical separation standards showed their dependency on the values assigned to individual errors, procedures used to combine the errors, and manner in which the overall error is considered in reference to the separation standard. S.P.

N66-29404# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF GYROSCOPIC DEVICES, PART II, CHAPTERS 7-11
S. S. Rivkin 30 Dec. 1965 539 p refs Transl. into ENGLISH from the book "Teoriya Giroskopicheskikh Ustroystv, Chast' II" Leningrad, Izd. Sudostroyeniye, 1964 p 1–548
(FTD-MT-65-96; AD-629424) CFSTI: HC $8.40/MF $2.25

This book is the second part of a work on the theory of gyroscopic devices (GD's) (the first part was published in 1962). In it the theory of active-type gyroscopic stabilizers, differentiating and integrating gyroscopes, gyroscopic navigational systems, and also certain questions of gyroscopic stabilization are considered. Basic attention is allotted to determination of dynamic errors of GD's in conditions of random controls and disturbances. The book is intended for engineering technical and scientific workers, studying questions of applied gyroscopy, and can serve as a training aid for students and post graduates, studying the theory of GD's. Author (TAB)

N66-29559# Hazeltine Electronics Div., Hazeltine Corp., Little Neck, N. Y.
ALPHA NUMERIC SYMBOL GENERATION EQUIPMENT Final Report
J. F. O'Connor Sep. 1965 132 p
(Contract FA-WA-4345)
(RD-65-103)

Two Alpha Numeric Generator equipments have been developed and installed. These equipments have passed all acceptance tests and are undergoing operation testing. These Alpha Numeric Generators electronically label aircraft radar blips on air traffic controller's displays with identity, altitude, vector, speed, and other data. Their use in the ARTS and SPAN air traffic control systems automates former manual functions of the controllers, reduces the necessary communications with aircraft pilots, and minimizes the possibilities of errors in air traffic control. A summary of development problems and test results on the Alpha Numeric Generators is given. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-28636# Sandia Corp., Albuquerque, N. Mex.
CONTROLLED DEORBIT
J. A. Leonard and W. W. Joseph Mar. 1966 47 p refs
(Contract AT(29-1)-789)
(SC-RR-65-472) CFSTI: HC $3.00/MF $0.50

Controlled deorbit is discussed as a means of disposal of orbiting SNAP satellites to reduce radiological hazards. Two types of controlled deorbit systems are considered: the command initiated retro-rocket system and the command deployable high-drag device. An example situation of deorbit from an eccentric transfer orbit, similar to that flown by SNAP-10A, is examined. Author (NSA)

N66-28643# Sandia Corp., Albuquerque, N. Mex.
PROBABILITY DISTRIBUTIONS OF LATTITUDES OF REENTRY AND IMPACT FOLLOWING DECAY OF POLAR ORBITS
T. S. Edrington Mar. 1966 31 p refs
(Contract AT(29-1)-789)
(SC-RR-66-41) CFSTI: HC $2.00/MF $0.50

The differential equations of orbital decay are developed and solved with an analog computer. A large number of solutions are used to derive a probability distribution of re-entry latitude. Re-entry range is determined as a function of re-entry latitude and used with the probability distribution of re-entry latitude to derive a probability distribution of impact latitude. Author (NSA)

N66-28714# TRW Systems, Redondo Beach, Calif.
STUDY OF THE CHEMICAL INTEGRITY OF RADIOISOTOPE CONTAINMENT MATERIALS IN LAUNCH ABORT ENVIRONMENTS Summary Technical Report Phase I
Albuquerque, N. Mex., Sandia Corp., Dec. 1965 68 p refs
Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-65-1918) CFSTI: HC $3.00/MF $0.75

The detailed search and analysis of the available data from the literature to establish quantitatively what is known about the high temperature chemical interaction of radioisotope containment materials with launch pad abort combustion gas species are reported. The materials that were considered included cobalt-base alloys, nickel-base alloys, stainless steels, coated and uncoated refractory metals, and noble metal claddings. The high temperature interaction of these materials with the combustion gas species O_2, N_2, CO, CO_2, NO, H_2O, and HF forms the basis of this report. Author (NSA)

N66-28812# National Lead Co. of Ohio, Cincinnati.
TEXTURE GRADIENTS OF VARIOUS DEGREES BY NLO PROCESSES
P. E. Henry *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-Ray Diffraction in the Atomic Energy Field Oct. 1965 p 29–41 refs (See N66-28808 16-17)
(Contract AT(30-1)-1156)

Uranium fuel cores produced by various fabrication processes and having different heat treatments have been evaluated by X-ray diffraction to determine the effects of geometry, heat-treatment quenching media, and certain fabrication characteristics upon theoretical growth indices. These indices are used to predict the anisotropic growth tendencies of the cores under irradiation by thermal neutrons. A shorter method of investigating texture gradients in the longitudinal, circumferential, and radial direction by examination of only three points across the core wall is discussed. Author

N66-28937# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
XENON AND SAMARIUM TABLES
Barbara B. Occhipinti Jul. 1965 222 p refs
(Contract AT(07-2)-1)
(DP-958) CFSTI: HC $6.00/MF $1.25

Tables are presented for calculating the reactivity transients that result from Xe^{135} or Sm^{149} poisoning in any thermal reactor that employs U^{235} as the principal fissionable material. Xenon and samarium concentrations are given as a function of time in units of absorptions per fission neutron. Tables are also given for the change in reactivity held in xenon after step reductions in power. Thermal flux is expressed in units of megawatts from thermal fissions per kilogram of U^{235}. These tables cover a range of power from 0 to 500 Mw/kg. Author (NSA)

N66-28938# Sandia Corp., Albuquerque, N. Mex.
SPACE POWER SUPPLIES
V. E. Blake [1965] 9 p Presented at Am. Nucl. Soc. Meeting, Santa Fe, N. Mex.
(Contract AT(29-1)-789)
(SC-DC-65-1131; CONF-650110-1) CFSTI: HC $1.00/MF $0.50

A brief survey is given of the history of the development of radioisotope, reactor, and solar-cell space power supplies. Power supplies using heat directly—the ROVER rocket propulsion reactor, the PLUTO nuclear ramjet, and the POODLE rocket thruster using Po^{210}—are described. The power systems using heat to generate electricity are discussed. Development of the reactors SNAP-2, SNAP-8, SNAP-10A, and SNAP-50 is surveyed. Requirements of isotope generators and the characteristics of Pu^{238}, Sr^{90}, Cs^{137}, Cm^{244}, and Po^{210} for SNAP applications are discussed. The isotope generators SNAP-3, SNAP-9A, SNAP-11, SNAP-17, and SNAP-19 are described. NSA

N66-28971# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-10 Plant.
THE PREPARATION OF HIGHLY ENRICHED U_3O_8 FOR THE HIGH FLUX ISOTOPE REACTOR CORE
J. R. Barkman 1 Feb. 1966 11 p
(Contract W-7405-ENG-26)
(Y-MA-450) CFSTI: HC $1.00/MF $0.50

Uranium fuel for the core of the High Flux Isotope Reactor (HFIR) was prepared in the form of a sintered U_3O_8 with a size range of 44 to 88 μ. The basic preparation method consisted of the precipitation of a solution of uranyl nitrate with H_2O_2, followed by calcining and sizing operations. The process was essentially a batch-type operation utilizing laboratory-type equipment because of the geometry restrictions imposed by nuclear safety and the availability of the equipment from other oxide production programs. Chemical and physical test data are appended. NSA

N66-28976# Southwest Research Inst., San Antonio, Tex.
METALLURGICAL EVACUATION OF THE LACBWR FORCED CIRCULATION CLAD PIPING
R. D. Wylie, Jose Mc Donald, K. K. Speirs, and P. D. Watson 24 Aug. 1965 80 p
(Contract AT(11-1)-1228)
(SWRI-1228-73) CFSTI: HC $3.00/MF $0.75

The material for the LaCrosse boiling water reactor forced circulation piping system is carbon steel (A212 Grade B) clad with austenitic (Type 304) stainless steel. Problems were encountered during the fabrication of the piping, and investigations were conducted to form a basis for acceptance of the clad pipe. The quality assurance program is given, and the repair and examination of clad pipe welds are described. NSA

N66-28994# General Electric Co., San Jose, Calif. Vallecitos Atomic Lab.
IRRADIATION PERFORMANCE OF ALTERNATE CLADDING MATERIALS
C. J. Baroch, J. P. Hoffmann, S. Y. Ogawa, and H. E. Williamson Sep. 1965 115 p refs
(Contract AT(04-3)-189)
(GEAP-4916) CFSTI: HC $4.00/MF $0.75

Three potential alternate cladding materials for boiling water reactor fuel rods were irradiation tested in the Vallecitos Boiling Water Reactor (VBWR). Irradiation data are

reported on fuel rods clad with 0.254 and 0.508 mm Incoloy-800 tubing, with Zircaloy-2 tubing lined with a 0.03 mm layer of stainless steel on the inside surface, and 0.127 mm type 304 stainless steel tubing. Author (NSA)

N66-29005# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THE STRENGTH OF IRRADIATED BERYLLIUM OXIDE FUELLED WITH UO_2ThO_2
G. L. Hanna and R. J. Hilditch Jul. 1965 14 p refs Submitted for Publication
(AAEC-E-140)

The mechanical strength of hot-pressed and cold-pressed and sintered dispersions of $(U,Th)O_2$ in BeO was measured before and after irradiation using the diametral compression test. The addition of more than 5 vol % $(U,Th)O_2$ lowered the unirradiated strength to about 60% of the strength of BeO. Irradiation resulted in a marked drop in strength of all coarse dispersions. Hot-pressed fine dispersions behaved similarly to coarse dispersions of the same composition, but the cold-pressed fine dispersions exhibited an appraent increase of strength on irradiation. High temperatures favored the retention of strength during irradiation. Author (NSA)

N66-29006# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION. Semiannual Report, Jul.–Dec. 1964
May 1965 283 p refs
(Contract W-31-109-ENG-38)
(ANL-6925) CFSTI: HC $6.00/MF $1.25

Research and development efforts on chemical separations processes for plutonium and uranium are reported. Pyrochemical process development was concerned with melt refining, processes using liquid metal solvents, fuel processing facilities for the EBR-II, fuel cycle facility operations, liquid metal chemistry, and fast reactor fuel preparations. Results of laboratory and engineering scale investigations on fuel cycle applications of volatility and fluidization techniques are presented. The status of work on high temperature phase relations and thermodynamic properties in the U–UO system is reviewed, vapor pressure and effusion data of U–UO systems are given, and results of U–US phase studies are presented. Combustion data on P, S, SiC, US, graphite, Mg, Al, Y, La, Gd, Ho, and TaB_2 in F_2 are provided. The design and operation of high temperature enthalpy calorimeters are described. Studies on metal–water reactions, fast reactor safety, and metal oxidation and ignition kinetics are discussed. Energy conversion studies are included on lithium hydride cells, electrode kinetics, intermetallic systems, liquid–vapor relations in the Na–Bi cell regeneration, and regenerative Emf cells. Also included are some nuclear constants, U^{235} fast fission yields, and cost studies of fuels and reprocessing methods for fast reactors. R.N.A.

N66-29009# Atomics International, Canoga Park, Calif.
DEVELOPMENT OF NOISE ANALYSIS TECHNIQUES FOR MEASURING REACTOR COOLANT VELOCITIES
R. L. Randall, P. J. Pekrul, and G. R. Grayban 25 Mar. 1966 37 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11193) CFSTI: HC $2.00/MF $0.50

The development of cross-correlation techniques and equipment for measurement of localized fluid velocities and flow distribution in hydraulic test models of SNAP reactor cores is described. The hydraulic test models are instrumented with electrical conductivity cells. Particular emphasis is given to the hydraulic apparatus and electronic data acquisition and reduction system. The basic approach is experimental with supplemental theory introduced as needed. A number of experiments are discussed in addition to the S8DS core baffle and velocity profile studies. These experiments include axial and crossflow tests and conductivity cell device studies. An improved cell design is discussed and an error analysis is presented for the S8DS core studies and the improved cell. Author (NSA)

N66-29013# Brookhaven National Lab., Upton, N. Y.
THE RANDOMLY PACKED SETTLED BED FAST REACTOR CONCEPT [1000-MW(e) REACTOR DESIGN]
L. Green and M. M. Levine, ed. 1 Jun. 1965 60 p refs
(Contract AT(30-2)-GEN-16)
(BNL-887) CFSTI: HC $3.00/MF $0.50

The design concepts of a 1000-Mw(e) settled-bed fast reactor are discussed in terms of the following: settled-bed physics, bed engineering, thermal and hydraulic characteristics, plant design, reactor, coolant systems, auxiliary systems, plant operations and procedures, and economics. NSA

N66-29016# TRW Systems, Redondo Beach, Calif.
HYDRODYNAMIC STABILITY OF NATURAL CIRCULATION BOILING SYSTEMS. VOLUME I: A COMPARATIVE STUDY OF ANALYTICAL MODELS AND EXPERIMENTAL DATA
L. G. Neal and S. M. Zivi 30 Jun. 1965 201 p refs
(Contract AT(04-3)-372)
(STL-372-14(1)) CFSTI: HC $5.00/MF $1.00

This study of hydrodynamic instability is presented in three parts. First, the mechanisms of instability considered by a number of authors are discussed, and the experimentally observed effects of various system parameters are summarized. Then, the basic conservation equations are derived in general form, and each model is described relative to these equations. Differences and similarities in the models are shown. Finally, the predictions of each model are compared with experimental data, and the relative predicting power of each model is evaluated. NSA

N66-29022# Oak Ridge National Lab., Tenn. Nuclear Safety Information Center.
CURRENT NUCLEAR SAFETY LITERATURE—4 Indexed Bibliography
May 1966 232 p refs
(Contract W-7405-ENG-26)
(ORNL-NSIC-14) Available from Oak Ridge Natl. Lab., Tenn.

Approximately 800 references on nuclear safety are given to reports, journals, books, and patents published during 1964 and 1965. Author and subject indexes are included. NSA

N66-29023# Aerojet-General Nucleonics, San Ramon, Calif. Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM: ML-1A SHIELD OPTIMIZATION STUDY
Dec. 1965 109 p refs
(Contract AT(10-1)-880)
(AGN-TM-412) CFSTI: HC $4.00/MF $0.75

Several external shield concepts were evaluated to select the design which involved the least compromise to plant shipping weight and startup time, while retaining the maximum flexibility for maintenance activities. The optimum shielding arrangement to satisfy the dose rate criteria specified for this study appears to consist of the following: modification of the reactor skid internal radial shield to the 3 in. tungsten–lead concept, modification of the reactor skid internal axial shield to the conical, reduced height concept, provision of a self-supporting membrane-type external water shield 44 in. thick, and use of 1.5 ft of sandbag expedient shielding to reduce the dose levels to 4 mRem/hr at 100 ft during reactor operation. The above four possibilities are discussed in detail. NSA

N66-29024# Argonne National Lab., Ill.
REACTOR PHYSICS DIVISION Annual Report, 1 Jul. 1964–30 Jun. 1965
Dec. 1965 436 p refs
(Contract W-31-109-ENG-38)
(ANL-7110) CFSTI: HC $7.22/MF $2.00

Several phases of analytical and experimental work on reactor physics are described. In research on fission properties and cross section data, efforts centered on studies of fast neutron induced processes, with attention given to neutron elastic and inelastic scattering, neutron induced reaction including capture, and the characteristics of the fission process. Reports are also presented on reactor systems in which a substantial portion of the fissions are caused by neutrons of thermal energy. Analytical and experimental work related to fast power breeder reactors, and the development of a fast spectrum nuclear rocket are summarized. Techniques, facilities, and radiation detection devices for obtaining reactor integral parameters are described, and the development of special equipment used in measurements relating to power reactor fuel element failures is discussed. Abstracted data are also presented on numerical analysis and code development for computing work in reactor physics; and problems relating to heat transfer, fluid dynamics in reactor safety experiments, fuel element stresses, and material properties are examined. M.G.J.

N66-29025# Bettis Atomic Power Lab., Pittsburgh, Pa.
MELBA TEST IN PWR CORE 2 BLANKET Summary Design Report
R. L. Henke, ed. Mar. 1966 76 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-483) CFSTI: HC $3.00/MF $0.75

A Multipurpose Extended Life Blanket Assembly (MELBA) was constructed and installed in the center blanket region of the Shippingport reactor containing PWR Core 2. Utilizing nine partially depleted fuel bundles taken from selected blanket fuel assemblies at the end of the PWR Core 1 lifetime, their further operation in Core 2 is intended to determine the burnup limitations of production grade Zircaloy-clad UO_2 rod type fuel elements in power producing reactor environments. The PWR Core 2 requirements are discussed along with the Core 1 fuel bundle nuclear, metallurgical, thermal, and hydraulic performance. The design, fabrication, and out-of-pile proof testing of the MELBA structure are described. Author (NSA)

N66-29043# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
NUFTIC—AN INFORMATION CENTER ON NUCLEAR FUEL TECHNOLOGY
R. L. Pilloton Mar. 1966 35 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1358) CFSTI: HC $2.00/MF $0.50

The amount of literature on the fabrication, evaluation, application, and economics of nuclear fuels is increasing rapidly. To cope with the difficulty of keeping informed, the Metals and Ceramics Division of the Oak Ridge National Laboratory has organized the Nuclear Fuel Technology Information Center (NUFTIC). In this center active scientists and engineers review the literature. A computer stores, searches, and prints information. The choice of information processing system, the method of operation of the center, and examples of the output are described. Author (NSA)

N66-29088# Sandia Corp., Albuquerque, N. Mex.
AEROSPACE NUCLEAR SAFETY
V. E. Blake, Jr. 18 Mar. 1966 11 p refs Presented at Am. Nucl. Soc. Topical Meeting, Augusta, Ga.
(Contract AT(29-1)-789)
(SC-DC-66-1369; CONF-660305-15) CFSTI: HC $1.00/MF $0.50

The development of radioisotope and reactor power sources for use in spacecraft is reviewed with emphasis on potential hazards and safety measures. The first space atomic power source (SNAP-3), demonstrated in 1959, used Po^{210} as fuel, weighed 4 lb, and produced about 2.5 watts of power in 90 days, was followed by a 1961 version fueled with Pu^{238}. In 1965 the first reactor power supply, SNAP-10A, was placed in orbit around the earth. This unit produced in excess of 500 watts of electrical power for a period of 43 days until shutdown. NSA

N66-29099# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
ADVANCED GRAPHITE FUEL SYSTEMS Quarterly Progress Report, 15 Aug.–14 Nov. 1965
J. C. Bokros, G. B. Engle, W. V. Goeddel, R. J. Price, and J. L. White 10 Dec. 1965 51 p refs
(Contract AT(04-3)-167)
(GA-6831) CFSTI: HC $3.00/MF $0.50

Developments in studies on the relation between binder–filler interactions the microstructure, preferred orientation, selected physical properties, and irradiation behavior of molded graphite bodies are reported. Molded bodies containing natural flake graphite showed that the molding process causes extensive damage to the flakes by bending, twinning and delamination; subsequent heat-treatment had little further effect. The calcined coke particles used in the molded bodies showed two types of structure: a lamellar structure suggestive of flow at some stage in coking; and a non-lamellar structure which includes relatively large non-graphitic regions. Investigations directed toward relating the preferred orientation and thermal expansion coefficient for non-graphitic carbons indicated a systematic dependence between the two variables similar to that observed for well-crystallized graphite. Final results of thermal conductivity measurements performed on seven pyrolytic carbon coatings, irradiated at 540° to 1080°C and to an exposure of $>10^{21}$ nvt (fast) in capsule G-9, confirmed that: low-density isotropic carbons show no change in conductivity; granular and medium-to-high density isotropic carbons decrease in conductivity; and laminar carbons increase in conductivity. Mechanical property measurements on the same pyrolytic carbon specimens indicated that the

elastic modulus increased sharply for all structures, i.e., from 30 to 100%. The relationship between radio-induced length changes and preferred orientation in polycrystalline graphite was investigated by measuring the pre- and post-irradiation dimensions of samples which were cut from an extruded graphite tube and had different preferred orientations. NSA

N66-29112# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
INTEGRAL NEUTRON THERMALIZATION Annual Summary Report, 1 Oct. 1964–30 Sep. 1965
J. R. Beyster, H. Antunez, W. Brouwer, J. Audas, G. Garriveau et al 1 Nov. 1965 230 p refs
(Contract AT(04-3)-167)
(GA-6824) CFSTI: HC $6.00/MF $1.25

Results of research in the following areas are presented: neutron thermalization in H_2O, D_2O, polyethylene, zirconium hydride, beryllium, and beryllium oxide; fast reactor studies; neutron spectra in heterogeneous assemblies; experimental and calculational techniques; universal scattering law code; neutron spectra book; and research facilities. NSA

N66-29116# Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Safety Div.
AEROSPACE SAFETY RESULTS FROM A ROVER/NERVA POST-OPERATIONAL DESTRUCT TEST
R. E. Berry Nov. 1965 17 p Presented at 13th Conf. on Remote Systems Technol., Washington, 15–18 Nov. 1965
(Contract AT(29-1)-789)
(SC-R-65-1017; CONF-651101-54)

The destruction of a full-scale mockup ROVER/NERVA propulsion engine was performed under the direction of the joint AEC/NASA Space Nuclear Propulsion Office. The data collected included information about the destruct debris velocity, size, weight, and spatial distribution. These data are a satisfactory source term for the computer analysis of the ROVER/NERVA Program safety. Author (NSA)

N66-29118# Junta de Energia Nuclear, Madrid (Spain). Div. de Metallurgia.
WELDING PROCEDURES USED IN THE FABRICATION OF FUEL ELEMENTS FOR THE DON REACTOR EXPONENTIAL EXPERIMENT [LA SOLDADURA EN LA FABRICACION DE ELEMENTOS COMBUSTIBLES DESTINADOS A UNA EXPERIENCIA EXPONENCIAL]
A. Diaz Beltran, E. Jaraiz Franco, and M. de las Rivas Diaz 1965 32 p In SPANISH
(JEN-156-DMe/I13)

The welding techniques used in the fabrication of UC and UO_2 fuel elements for an exponential experiment in the DON reactor are described. NSA

N66-29329*# National Aeronautics and Space Administration, Washington, D. C.
FEATURES OF CONTACT HEAT TRANSFER IN REACTOR FUEL ELEMENTS [OSOBENNOSTI KONTAKTNOGO TEPLOOBMENA V TEPLOVYDELYAYUSHCHIKH ELEMENTAKH REAKTORA]
V. S. Miller Apr. 1964 9 p refs Transl. into ENGLISH from Izv. Vysah. Uchab. Zaved., Energ. (Minsk), No. 3, 1962 p 67–70
(NASA-TT-F-8849) CFSTI: HC $1.00/MF $0.50 CSCL 18J

Basic laws of the variation in contact thermal resistance as a function of different factors were derived from experimental investigations of contact heat transfer between metallic and metal-ceramic surfaces. The contact heat transfer similar to that between the core and jacket of a reactor fuel element, was investigated at large specific heat fluxes (450,000–500,000 kcal/m^2·hr) and high temperatures between the contact surfaces (350°–400°C) in the presence of different gaseous media. It was experimentally established that an increase in the smoothness of the contact surfaces contributes to a decrease in thermal resistance. The heat flux across the contact zone is by conduction through metal contacts and the intermediate gas layer, and radiation between the surfaces. Experimental data indicate that most of the heat flux from the hotter to the cooler surface is due to conduction through the gaseous medium, and that as the heat conductivity of a gas decreases the contact thermal resistance considerably increases. R.U.

N66-29513*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MASS-RETENTION MEASUREMENTS IN A BINARY COMPRESSIBLE VORTEX FLOW
Thomas J. Pivirotto 15 Jun. 1966 31 p refs
(Contract NAS7-100)
(NASA-CR-75932; JPL-TR-32-864) CFSTI: HC $2.00/MF $0.50 CSCL 18I

Confined binary vortex flow fields have been proposed as gaseous-fuel-retention devices for gas-core nuclear reactors. Several such flows have been evaluated in this investigation by measuring the mass flow rate of heavy gas discharging from the vortex tube. Hydrogen and nitrogen were used to generate the vortex flow fields and Freon-13 was used for the heavy gas. An infrared photometer operating at a wavelength of approximately 8.3μ was developed and used to measure the transient decay of the discharge rate of Freon after an abrupt cutoff of Freon inlet flow. From these measurements the average residence time of the Freon particles in several vortex-tube configurations for several mass flow rates of Freon and hydrogen or nitrogen were determined. The conclusion reached from the results of this investigation was that these particular vortex flow fields do not retain significantly more Freon than would be contained in the same device and under the same conditions of pressure and temperature if no diffusion occurred between the light and heavy species. Author

N66-29532# United Kingdom Atomic Energy Authority, Harwell (England).
LIST OF PUBLICATIONS AVAILABLE TO THE PUBLIC Cumulation No. 10, Jan.–Dec. 1965
Feb. 1966 139 p refs
HMSO: 17s

A compilation of the United Kingdom Atomic Energy Authority publications is presented and contains details of unclassified reports, translations, periodical articles, books, and patent specifications listed during 1965. The publications cover the areas of biology; medicine; agriculture; general, radio, radiation, nuclear, and analytical chemistry; chemical engineering; general engineering; instrumentation; geology and mineralogy; health and safety; industrial applications of isotopes; mathematics and computers; metallurgy and materials; radiation effects on materials; general, solid state, nuclear, and theoretical physics; plasma physics and controlled fusion research; particle accelerators; reactor physics; and waste disposal. R.N.A.

N66-29636# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
FREQUENCY OF OCCURRENCES OF MAXIMUM POLLUTION LEVELS FROM SINGLE STACKS
P. J. Barry Jun. 1966 12 p refs Presented at Natl. Meteorol. Congr., Royal Meteorol. Soc., Sherbrooke, Quebec, 8-10 Jun. 1966
(AECL-2575) CFSTI: HC $1.00/MF $0.50

A radioactive noble gas, Argon 41, is discharged continuously from the CRNL stack at an almost constant rate. The concentration of the gas at ground level has been measured continuously at four sampling stations at various distances around the stack. The magnitude of extreme pollution levels occurring in the vicinity and also the frequency with which extreme levels of different magnitudes occur have been estimated from the results. The occurrence of extreme pollution levels is related to such meteorological variables as atmospheric stability and wind turbulence. Author

N66-29580# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
REMOTE HANDLING OF MOBILE NUCLEAR SYSTEMS
Douglas C. Layman and Gunnar Thornton Oak Ridge, Tenn., AEC, Jan. 1966 655 p refs
(Contract AT(40-1)-2847)
(TID-21719) CFSTI: HC $4.50/MF $2.75

Technology developed during the Aircraft Nuclear Propulsion program is described. Information is given on: nuclear systems and the Idaho Test Station, remote-handling procedures and support equipment, general-purpose facilities and tools, facilities and equipment in the shop building, related services, mechanical parts, shielding calculations, radiation effects, and health physics. Data on specification for a hot-shop wall-mounted boom and manipulator, specifications for radioactive core service area wall-mounted boom, remotely handled electrical connector, methods of calculating induced activity, and radiation calculations are appended. NSA

N66-29583# Atomics International, Canoga Park, Calif.
DEVELOPMENT OF A SOLID STATE NEUTRON DETECTOR FOR SNAP 10A
A. Chesavage 25 Mar. 1966 44 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11762) CFSTI: HC $2.00/MF $0.50

Electronic devices, primarily semiconductors, degrade in a nuclear radiation environment. In a reactor environment most of the damage is due to fast neutrons. The lithium hydride shield on SNAP 10A was designed to attenuate the fast neutron exposure at the instrument compartment to a tolerable level. To evaluate shield effectiveness fast neutron detectors were developed. Eight detectors were installed in the SNAP 10A FS-4 flight system. The development and in-flight data of these detectors are discussed. NSA

N66-29584# Atomics International, Canoga Park, Calif.
NEUTRON FLUX MONITORING WITH ARGON GAS Final Report
C. R. F. Smith and A. J. Saur 25 Mar. 1966 146 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11356) CFSTI: HC $4.00/MF $1.00

A flowing stream of argon gas was used to monitor neutron flux in nuclear reactors over the ranges 27 to 380°C simulated in-core temperature and 1 w to 1 Mw reactor power. The system consisted of small bore inlet and outlet tubes, leading to and from an in-core activation chamber where the reaction, $^{40}Ar(n,\gamma)^{41}Ar$, primarily took place. ^{41}Ar in the affluent stream was directed through a NaI(Tl) scintillator crystal which measured the rate of decay of ^{41}Ar by (β,γ) emission to nonradioactive ^{41}K. A number of equations were derived, whereby neutron flux could be computed from various system parameters. The variables among these parameters were: pressures at the inlet and outlet tubes and at the in-core chamber, temperatures at the same locations, mass flowrate, countrate, and an efficiency factor for the crystal. Various configurations of gas handling systems were tested. It was found that, at constant reactor power, computed neutron flux could be held within 5% over the temperature range cited above. It was also shown that computed neutron flux was virtually linear with reactor power over the six decades of power. A modified system is described, whereby neutron flux (as indicated by the scintillator countrate alone) could be made virtually insensitive to reactor temperatures (to within about 5%) over a range of 277 to 702°C. Finally, it is suggested that, in spite of a greatly reduced absorption cross section for argon, this system would be able to monitor neutron flux, in core and continuously, in fast-flux nuclear power reactors. NSA

N66-29607# Los Alamos Scientific Lab., N. Mex.
HIGH YIELD ^{233}U CASTING OPERATIONS
R. R. Gilmore and D. R. Harbur Nov. 1965 22 p refs Presented at Am. Foundrymen's Soc. Conv., Cleveland
(Contract W-7405-ENG-36)
(LA-DC-7510; CONF-660501-1) CFSTI: HC $1.00/MF $0.50

One of the fissionable isotopes of uranium (U^{233}) has a low critical mass, thus making high-yield castings a necessity. Since urnaium has a 5% volume change on freezing, there is a serious piping problem. A method of directionally cooling the casting during solidification, has essentially eliminated the piping problem and the need for excess material in a riser-sprue type mold which would normally be used. The equipment and procedures used for casting urnaium^{233}, together with the nuclear safety precautions needed are described. Author (NSA)

N66-29610# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
ACCURATE NUCLEAR FUEL BURNUP ANALYSES Quarterly Progress Report No. 14, Feb.-May 1966
B. F. Rider, C. P. Ruiz, J. P. Peterson, Jr., and F. R. Smith 1 Jun. 1965 29 p refs
(Contract AT(04-3)-189)
(GEAP-4893) CFSTI: HC $2.00/MF $0.50

The fabrication and testing of a system for the quantitative recovery of Kr and Xe gas released during the dissolution of irradiated fuel continued. The contents of ^{236}Pu and ^{238}Pu in irradiated UO_2 fuel for boiling-water reactors were measured and were compared with theoretical predictions. The yields of ^{133}Cs, ^{137}Cs, ^{143}Nd, ^{144}Nd, ^{145}Nd, ^{146}Nd, and ^{150}Nd in neutron fission of ^{239}Pu, ^{233}U, and ^{235}U were also measured. Derivations of equations for the determination of burnup from $^{236}U/^{235}U$ ratios were repeated. NSA

N66-29614# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
RAD 2: A COMPUTER PROGRAM FOR CALCULATING FISSION PRODUCT RADIOACTIVITIES

F. E. Vanslager 23 Jul. 1965 33 p
(Contract AT(04-3)-167)
(GAMD-6519) CFSTI: HC $2.00/MF $0.50

The computer program RAD 2, a Fortran IV program that is designed to calculate fission-product activity distributions in a high-temperature gas-cooled reactor system, is described. The equations used by the program are given, and a program listing is included. NSA

N66-29619# Oak Ridge National Lab., Tenn.
DESCRIPTION OF FACILITY RADIATION AND CONTAMINATION ALARM SYSTEMS INSTALLED IN THE HIGH FLUX ISOTOPE REACTOR FACILITY, BUILDING 7900
J. A. Russell Jr. and D. J. Knowles 8 Dec. 1965 18 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1393) CFSTI: HC $1.00/MF $0.50

Facility radiation and contamination systems were installed in the High Flux Isotope Reactor Facility, to continuously and automatically monitor the gamma radiation level and air contamination level in the entire facility. The monitoring instruments in the network are used to provide health physics monitoring information, local alarms when abnormal conditions occur, and remote alarms on a central monitoring panel located on the reactor control panel. Nine monitrons continuously monitor for gamma radioactivity. Five of these monitrons are used in the facility radiation alarm system. Nine constant air monitors continuously sample the air in the building for radioactive (beta–gamma) particulate material. Six of these constant air monitors are used in the facility contamination alarm system. A description of the facilities is presented. NSA

N66-29713# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING OCTOBER, 1965
Russel W. Dayton and Stan J. Paprocki 1 Nov. 1965 35 p refs
(Contract W-7405-ENG-92)
(BMI-1748) CFSTI: HC $2.00/MF $0.50

Progress in studies on reactor materials and components, fuels, PuN–UN fuel materials, radioisotope and radiation applications, coated-particle fuel materials, and corrosion in the fluidized-bed fluoride-volatility process is reported. NSA

N66-29716# Los Alamos Scientific Lab., N. Mex.
NUCLEAR REACTOR MAGNETOHYDRODYNAMIC POWER GENERATION
Ralph S. Cooper, Lawrence A. Booth, R. J. Fries, P. G. Salgado, L. D. Kirkbride et al 20 Jan. 1966 52 p refs
(Contract W-7405-ENG-36)
(LA-3368) CFSTI: HC $3.00/MF $0.50

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N66-29718# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TRANSIENT THERMAL BEHAVIOR IN FIXATION OF RADIOACTIVE MATERIALS
G. Jansen, Jr. and W. V. De Mier Jan. 1966 141 p refs
(Contract AT(45-1)-1830)
(BNWL-157) CFSTI: HC $4.00/MF $0.75

Dimensionless correlations are given for the thermal history of cylindrical, infinite-slab, and annular heat-generating radioactive material containers after fixation at elevated temperatures. The maximum temperatures attained are presented as functions of heat generation rate, initial temperature, container geometry, thermal conductivity, and environmental heat transfer coefficient. The effect of heat losses through the ends of a solid cylindrical container is also presented for steady state conditions. Several examples are given as an aid to calculations. Computer programs for more detailed estimation of thermal histories in slabs, cylinders, and annuli are appended.
Author (NSA)

N66-29770# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
THE ROLE OF POWDER METALLURGY IN THE FABRICATION OF VERY LARGE PARTS
A. C. Neeley, J. M. Googin, and J. J. Asbury 18 Feb. 1966 10 p Presented at Am. Soc. of Tool and Mfg. Engr. Ann. Conf. and Tool Show, Detroit, 18–22 Apr. 1966
(Contract W-7405-ENG-26)
(Y-DA-1043; CONF-660402-2) CFSTI: HC $1.00/MF $0.50

The fabrication of a lithium hydride reactor shield, a tungsten crucible weighing 1700 lbs, and an aluminum oxide insulator measuring 70 in. in length and 23 in. in dia is described. Each component illustrates the application of basic powder metallurgy techniques that are equally applicable to metal or ceramic powders. NSA

N66-29775# Oak Ridge National Lab., Tenn.
INTERIM POSTIRRADIATION EXAMINATION OF A EUROPIUM-BEARING CONTROL ROD FROM THE STATIONARY MEDIUM POWER REACTOR
A. E. Richt Mar. 1966 15 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1407) CFSTI: HC $1.00/MF $0.50

A neutron-absorber element containing Eu was examined nondestructively after 10.1 Mwyr of service in the Stationary Medium Power Reactor (previously referred to as APPR-1

This element, of the type originally designed for Core II service, consists of four composite absorber plates welded to form a square, hollow tube. The stainless steel-clad absorber plates contain a dispersion of 37 wt % Eu_2O_3 in stainless steel as the neutron-absorbing material. Results of this examination indicate that the absorber element is in excellent condition. No evidence of damage was visually apparent, gamma scans showed no indication of abnormalities in the absorber burnup distribution, and the outer dimensions of the element were found to be well within fabrication tolerances. The individual absorber plates were found to be slightly thicker in regions of high burnup; however, the position of this thicker region is characteristic of the as-fabricated plates and not a result of irradiation-induced swelling. The absorber element was placed in temporary storage until arrangements for additional testing in the Stationary Medium Power Reactor are complete. Author (NSA)

N66-29784# Oak Ridge National Lab., Tenn.
A MACHINE TO TRANSFER POWDERED RADIOACTIVE FUEL REMOTELY
F. C. Davis and W. A. Pate 28 Jan. 1966 17 p
(Contract W-7405-ENG-26)
(ORNL-TM-1397) CFSTI: HC $1.00/MF $0.50

A fuel transfer machine was designed for use as one of the machines in an assembly line that will constitute the Oxide Fabrication Process planned for the Thorium–Uranium Fuel Cycle Development Facility being constructed at Oak Ridge National Laboratory. The fuel transfer machine will receive the thorium–uranium oxide powder from the weighing machines, blend the fuel while transporting it to the fill-compact machine, and empty the blended fuel material into the fill-compact machine. The requirements, problems, the solution of those problems encountered in the design for the fuel transfer machine are disucssed. Author (NSA)

N66-29785# Japan Atomic Energy Research Inst., Tokyo.
RADIATION LEAK TEST OF SHIELDED CELLS AT REPROCESSING ANALYTICAL FACILITY
Satoru Emura, Mamoru Onuki, Yoshinori Nakahara, and Naohiro Suyama 1965 52 p refs In JAPANESE; ENGLISH summary
(JAERI-1089)

For an analytical cell and sampling blister cell having 15-cm lead shields at the Reprocessing Analytical Facility, radiation leak tests were carried out using approximately 1.5 Curies cobalt-60 as the point source. Radiation levels and surface dose rates were measured by G-M counters and ionization survey meters. As a result of the measurements, some radiation leak was found where ball socket assemblies were located, for both the cells. However, this would be no problem in the normal operation of cells. Leaks were also detected at places where shielding was not sufficient, e.g., close to the duct on the analytical cell roof, the shield between the E and M cells, around the transfer tunnel, and the joint of the sampling blister cell and the concrete wall. It was concluded that, by reinforcing these places in the radiation shielding, up to about 30 Curies of F. P. could be safely handled in the analytical cell and up to about 20 Curies in the sampling blister cells. NSA

N66-29880# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
COMPREHENSIVE CAVITATION DAMAGE DATA FOR WATER, MERCURY, AND LEAD–BISMUTH ALLOY INCLUDING CORRELATIONS WITH MATERIAL AND FLUID PROPERTIES Technical Report No. 4
R. Garcia, F. G. Hammitt, and R. E. Nystrom May 1966 91 p refs
(Grant NSF G-22529)
(Rept.-05031-4-T)

Ultrasonic-induced cavitation studies have been conducted in lead–bismuth alloy at 500°F and 1500°F, in mercury at 70°F and 500°F, and in water at 70°F for a wide variety of materials, including refractory alloys, steels, brasses, copper, nickel, plastics, etc. Comprehensive computer correlations of the cavitation damage data with applicable mechanical and fluid properties have been carried out. The major conclusions of the study are: (1) The tantalum-base alloys were the most cavitation resistant in all the tests except in mercury at 70°F, where the stainless steels were the most resistant. (2) All materials tested in lead–bismuth at 500°F and 1500°F, and all materials tested in mercury at 70°F and 500°F sustained greater damage at the higher temperature with the exception of carbon steel. (3) Corrosion effects in those regions where cavitation was absent were negligible in this investigation. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-28424# Joint Publications Research Service, Washington, D. C.
EXPERIMENTAL DETERMINATION OF THE COEFFICIENT OF EXTINCTION OF TURBID MEDIA
J. A. Timofeyeva and L. A. Koveshnikova *In its* Recent Studies in Meteorology and Oceanog. 3 Jun. 1966 p 26–33 refs (See N66-28420 16-13) CFSTI: $2.00

The dependence between the scattering coefficient and the attenuation coefficient of maximum scattered light entering a turbid media was studied in order to clarify the influence of parasitic light on the results of photometric studies of milky media. The ratio of the scattering coefficients measured by instruments with different divergence angles was graphically evaluated. It was found that an increase of the light flux divergence induced considerable understating of the scattering coefficient value. The error in the coefficient of extinction value caused by parasitic light was proportional to the spatial divergence angle of a light beam with the power 0.18. The error increased with an increase of the spatial angle considerably slower than assumed due to the elongation of the scattering indicatrix of the milky medium. G.G.

N66-28450# Joint Publications Research Service, Washington, D. C.
THE CONTROL LAW FOR AN AIRPLANE FLYING FROM ONE POINT TO ANOTHER IN THE SHORTEST TIME
G. F. Molokanov *In its* News of the Acad. of Sci. USSR Dept. of Tech. Sci. Tech. Cybernetics No. 1, 1966 6 Jun. 1966 p 241–253 refs (See N66-28428 16-10) CFSTI: $6.00

The analytical solution of the variation problem for finding the trajectory of minimum time of flight between two points taking into account the curvature of the Earth is given. The analysis of the equations obtained is based on the real characteristics of the wind field. The solution of the problem is carried to the machine calculation of the course on the basis of

data about the geopotential field. It is shown that long distance flight along the minimum time trajectory can give significant economic advantages. Author

N66-28508# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Dec. 1965 53 p refs
(PB-168986) CFSTI: $1.25

CONTENTS:

1. THERMAL ANNEALING OF IRRADIATED n-on-p SILICON SOLAR CELLS R. V. Tauke p 1–6 refs (See N66-28509 16-03)
2. ELECTRON BEAM SCANNING TECHNIQUE FOR MEASURING SURFACE WORK FUNCTION VARIATIONS G. A. Haas and R. E. Thomas p 7–12 (See N66-28510 16-26)
3. APPLICATIONS RESEARCH F. R. Fluhr p 13
4. ATMOSPHERE AND ASTROPHYSICS G. L. Knestrick et al p 13–15 refs
5. CHEMISTRY J. G. O'Rear et al p 15–18
6. ELECTRICITY W. K. Gardner et al p 18–21 refs
7. MECHANICS J. A. Davis p 21–22
8. METALLURGY AND CERAMICS R. W. Judy, Jr. et al p 22–33 refs
9. NUCLEAR AND ATOMIC PHYSICS R. B. Theus et al p 33–37 refs
10. OPTICS G. L. Stamm et al p 37–39
11. RADIO J. A. Buisson, III, and H. G. deVezin, Jr. p 39
12. INDEX OF ARTICLES (JANUARY–DECEMBER 1965)

N66-28514# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Apr. 1966 49 p refs
(PB-169690) CFSTI: $1.25

CONTENTS:

1. LASER ACTION IN TRIPLY ACTIVATED GLASS H. W. Gandy, R. J. Ginther, and J. F. Weller p 1–9 refs (See N66-28515 16-26)
2. RAPID ANALYSIS WITH A GAS CHROMATOGRAPH–MASS SPECTROMETER COMBINATION F. E. Saalfeld p 10–18 (See N66-28516 16-14)
3. APPLICATIONS RESEARCH Barbour L. Perry and Patricia A. Griffin p 19
4. CHEMISTRY B. J. Piersma et al p 19–21
5. METALLURGY AND CERAMICS R. J. Goode et al p 21–30 refs
6. OPTICAL PHYSICS R. C. Eckardt et al p 30–34 ref
7. RADIO C. I. Phipps p 34–36 ref
8. SOLID STATE PHYSICS S. Levinson and F. L. Carter p 36–38 refs
9. APPLICATION OF PINLITES TO A HEADS-UP DISPLAY FOR PILOTS V. Gagner p 38–40

N66-28520# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Feb. 1966 49 p refs
(PB-169297) CFSTI: $1.25

CONTENTS:

1. DETERMINATION OF DISSOLVED GASES IN BODY FLUIDS J. W. Swinnerton p 1–5 refs (See N66-28521 16-04)
2. ON THE RELATIVISTIC TRANSFORMATION OF SPIN I. Manning p 6–9 refs (See N66-28522 16-24)
3. MECHANICS A. M. Sullivan et al p 10–14 refs
4. METALLURGY AND CERAMICS D. G. Howe et al p 14–27 refs
5. RADIO R. P. Little and H. L. Vess p 27–29 refs
6. SOLID STATE PHYSICS Esther W. Claffy p 29–30 refs
7. SOUND H. L. Peterson et al p 30–34 refs
8. REMOTE MACHINING OPERATIONS IN THE HIGH LEVEL RADIATION LABORATORY H. E. Watson et al p 35–36
9. A HYBRID CUMULATIVE PHASE DIFFERENCE METER G. G. Nacht and H. L. Peterson p 37–38

N66-28739# India. Dept. of Atomic Energy, Bombay.
LECTURES ON SOLID AND LIQUID STATE PHYSICS
1965 254 p refs
CFSTI: HC $6.00/MF $1.50

CONTENTS:

1. ELASTIC DIFFUSE SCATTERING OF NEUTRONS BY DILUTE FERROMAGNETIC ALLOYS G. G. Low (United Kingdom Atomic Energy Authority) p 1–41 refs (See N66-28740 16-26)
2. DYNAMICS OF CRYSTAL LATTICES W. Cockran (Edinburgh Univ.) p 43–101 refs (See N66-28741 16-26)
3. CO-OPERATIVE MODES OF MOTION IN LIQUID METALS P. A. Egelstaff (United Kingdom Atomic Energy Authority) p 103–139 refs (See N66-28742 16-24)
4. THEORY OF NEUTRON SCATTERING FROM LIQUIDS K. S. Singwi (Argonne Natl. Lab.) p 140–177 refs (See N66-28743 16-24)

N66-28793*# Illinois Univ., Urbana. Coordinated Science Lab.
STUDY OF THE ADSORPTION OF GASES ON METALS BY THE AUGER PROCESS
In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Meas. Apr. 1966 p 86–96 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

The apparatus under construction to measure the degree of surface coverage using the Auger process is described. It will use an electron impact helium ion source, leading to a cylindrical lens which focuses the ions onto the target. The target is a single crystal tungsten ribbon mounted on two heating leads which pass directly into a liquid nitrogen cooling bath. A schematic of the adsorption–desorption experiment is included, and the experimental technique is illustrated. N.E.N.

N66-28825#
DESIGN OF A GENERAL CORRELATION RELATIVITY THEORY [ENTWURF EINER ALLGEMEINEN KORRELATIVITAETS-THEORIE]
Julius F. Glueck and Michael J. Glueck 1966 16 p In GERMAN
CFSTI: HC $1.00/MF $0.50

Velocity correlation between two k-quanten with common intersection in a self-rotating system was used to develop the underlying microphysical processes of quantum mechanics. This smallest possible quantum system was related to Plank's quantum "h" by the formula: h=2k quanten. Since at high k-quanten correlation the mass effect increased and the kinetic energy decreased, it was concluded that elementary particles smaller than photons exist which possess a higher than light velocity. Transl. by G.G.

N66-28841# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLIED MATHEMATICS AND MECHANICS Selected Articles

18 Feb. 1966 50 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 29, no. 1, 1965 p 106–113; 141–155
(FTD-TT-65-1778/1+2+4; AD-629416) CFSTI: HC $4.60/MF $0.50

CONTENTS:

1. VARIATION PROBLEM OF THREE-DIMENSIONAL SUPERSONIC FLOWS V. M. Borisov p 1–15 refs (See N66-28842 16-12)

2. ON THE CONSTRUCTION OF TWO-DIMENSIONAL EQUATIONS OF THE THEORY OF ELASTIC THIN PLATES A. L. Gol'denveyzer and A. V. Kolos p 16–43 refs (See N66-28843 16-32)

N66-28862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AUTOMATIC FILTER SUBSTITUTION TO RECORD PRONOUNCED CHANGES IN LUMINOUS FLUX

O. I. Kasatkina (Golikova) and L. B. Krasil'shchikov *In its* Main Geophys. Obs. 25 Oct. 1965 p 10–13 (See N66-28860 16-20) CFSTI: HC $1.60/MF $0.50

The ratios of light flows corresponding to the maximum and minimum scattering of light by drops of water exhibiting diameters of 5 to 50μ may reach 10^4. To retain approximate constant accuracy of measurement in recording the light-scattering index for cloud-drop models, a device is proposed automatically to actuate and dissengage the required weakening light filters. Author

N66-28973# California Univ., Berkeley. Lawrence Radiation Lab.

MAGNET DESIGN APPLICATIONS OF THE MAGNETOSTATIC COMPUTER PROGRAM CALLED SIBYL

Joseph H. Dorst 7 Sep. 1965 13 p refs Presented at 1st Intern. Symp. on Magnet Technol., Stanford, Calif., 8–10 Sep. 1965 Submitted for Publication
(Contract W-7405-ENG-48)
(UCRL-16389; CONF-650922-16) CFSTI: HC $1.00/MF $0.50

The computer program SIBYL was used extensively in the design studies of magnets for a 200-BeV synchrotron at the Lawrence Radiation Laboratory, Berkeley. The code was written for static evaluation of two-dimensional magnets including the effects of finite non-uniform permeability of the iron. The general operation of the code and some of the special features are described. The code is especially useful for studying small differences between similar magnets. Applications include evaluation of the effects of iron saturation as a function of current, shaping of the pole base of AGS-type gradient magnets, shaping of magnet poles for good medium-field profiles, and partial evaluation of quadrupole magnets. The validity or accuracy of the computed results is discussed. The comparisons of calculated and measured fields of the CERN proton synchrotron magnet indicate the attainable quality of computed results. At 14.4 kG, within the limits of the vacuum chamber, the gradient computed by SIBYL was within 1% of the measured gradient. Author (NSA)

N66-28986# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON SYMMETRY GROUPS IN CLASSICAL AND QUANTUM MECHANICS [O GRUPPAKH SIMMETRII V KLASSICHESKOI I KVANTOVOI MEKHANIKE]

P. Winternitz, Ya. A. Smorodinskii, M. Uglirzh, and I. Frish 1965 18 p refs In RUSSIAN Submitted for Publication
(JINR-P-2529)

All potentials having a dynamical symmetry group in a two-dimensional world are found. Classical and quantum motion in these potentials is investigated and it is shown that in all cases the symmetry group is SU(2). The previously known potentials with higher symmetry (Coulomb potential, harmonic oscillator) are obtained as special cases. Author (NSA)

N66-28996# Iowa State Univ. of Science and Technology, Ames.

COMPUTER PROGRAM FOR FERMI SURFACE STUDIES

R. J. Anderson and M. K. Rhyne 1 Sep. 1965 74 p refs
(Contract W-7405-ENG-82)
(IS-1108) CFSTI: HC $3.00/MF $0.75

A FORTRAN computer program used to calculate cross-sectional areas of the Fermi surface and cyclotron masses is described. The application of this program to the face-centered-cubic metal lead, based on an orthogonalized-plane-wave interpolation model, is given. Author (NSA)

N66-29017# Stanford Univ., Calif. Stanford Linear Accelerator Center.

MAGNETIC CHARACTERISTICS OF THE ACCELERATOR QUADRUPOLE TRIPLETS

J. K. Cobb and A. W. Burfine Jan. 1966 36 p refs
(Contract AT(04-3)-515)
(SLAC-55) CFSTI: HC $2.00/MF $0.50

The results of the measurement of certain electric and magnetic characteristics of 62 of the QA magnets and 31 of the QB magnets are presented in statistical form. NSA

N66-29018# Stanford Univ., Calif. Stanford Linear Accelerator Center.

2-METER SPARK CHAMBER MAGNET MODEL FOR THE DETERMINATION OF FIELD DISTRIBUTION IN SPACE

H. Brechna, E. Burfine, R. Mizrahi, and A. Wolff Jan. 1966 79 p refs
(Contract AT(04-3)-515)
(SLAC-57) CFSTI: HC $3.00/MF $0.75

A 1/10-scale electromagnetic model of the 2-meter spark chamber magnet to be used at the End Station A area at SLAC was built to determine the axial and radial magnetic field distribution inside and outside the gap. Starting with a symmetric iron core and uniform distribution of ampere-turns on both poles, the model was changed gradually to the form which complies with the present design of the 2-meter spark chamber magnet. Field measurements performed on all models are described. Author (NSA)

N66-29038# Iowa State Univ. of Science and Technology, Ames.

THE CALCIUM–YTTERBIUM SYSTEM

Sven Dale Soderquist (M.S. Thesis) Nov. 1965 49 p refs
(Contract W-7405-ENG-82)
(IS-T-70) CFSTI: HC $2.00/MF $0.50

The calcium–ytterbium phase diagram was determined by differential thermal analysis. It is characterized by two solid solutions, one fcc and the other bcc, in correspondence with the low and high temperature allotrope of each element. From low temperature resistivity measurements it

was concluded that there is no long range ordering or immiscibility in the fcc solution. A Debye temperature of 260°K±12.5° for fcc calcium calculated from the resistivity data is in fair agreement with literature value (specific heat) of 235°K. Similarly, a Debye temperature for fcc ytterbium of 121.5°K±7.5 is in good agreement with the literature value (specific heat) of 118°K. Author (NSA)

N66-29060# International Centre for Theoretical Physics, Trieste (Italy).
GENERAL EIGENFUNCTION EXPANSIONS AND GROUP REPRESENTATIONS
K. Maurin (Warsaw Univ.) Feb. 1966 14 p refs
(IC-66/12)

Results concerning a general theory of eigenfunction expansions for families of commuting self-adjoint operators in a separable Hilbert space are presented. The fundamental notion of the Hilbert–Schmidt (H–S) mapping is reviewed, and the definition of a nuclear space by means of H–S mappings is given. After other remarks on irreducible representations, it is shown that the irreducible spaces $H(\lambda)$ are common generalized eigenspaces of some self-adjoint operators constructed in a natural way. NSA

N66-29091# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL TREATMENT OF AN ELEMENTARY QUANTUM MECHANICS PROBLEM
Karl Fritz 7 Jan. 1966 13 p
(Contract W-7405-ENG-48)
(UCRL-14643-T) CFSTI: HC $1.00/MF $0.50

It is shown that approximating the Schroedinger equation with a particular simple potential by a finite-difference equation and solving the eigenvalue problem by setting the determinant of the coefficients equal to zero is a convergent procedure for all eigenvalues if it converges for the lowest eigenvalue. Furthermore, it is likely that the eigenvectors converge to their respective eigenfunctions. NSA

N66-29129# New York Univ., N. Y. Dept. of Physics.
LOW TEMPERATURE PROPERTIES OF LIQUID He^3
A. E. Glassgold [1965] 33 p refs Presented at the Intern. Symp. on Inelastic Scattering of Neutrons from Condensed Systems, Upton, N. Y., 20–22 Sep. 1965
(Grant DA-ARO(D)-31-124-G523)
(A65-4; AROD-4614-5; AD-631806) CFSTI: HC $2.00/MF $0.50

A review is presented of simple theoretical concepts and current experimental results on the properties of liquid helium-3 at low temperatures and low pressures. Some of the topics covered are the extent of experimental confirmation of Landau's theory of the Fermi Liquid; the possible transition into a superfluid phase; the observation of zero-sound; and the importance, and present difficulties, in 'microscopic' probing of the elementary excitations. Author (TAB)

N66-29136# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
EXPERIMENTAL STUDY OF SOUND POWER RADIATED FROM COLD MODEL JETS AND GROUND SILENCING ARRANGEMENTS. VOLUME II, APPENDIX III: SOUND POWER DATA IN TABULAR FORM Final Report, Dec. 1962–Jul. 1964
Norman E. Barnett Jul. 1965 572 p *lts* Rept.-05478-6-F
(Contract AF 33(657)-8802)
(AFAPL-TR-65-55, Vol. 2; AD-631628) CFSTI: HC $5.70/MF $2.50

The report contains the detailed one-third octave band sound power data for the majority of the complete tests conducted during the research program. The various graphs in the body of the report were abstracted from these tables and the corresponding table numbers are reported on each graph. TAB

N66-29200# Naval Research Lab., Washington, D. C.
A REVIEW OF WORLD CONTRIBUTIONS FROM 1945 TO 1965 TO THE THEORY OF ACOUSTIC RADIATION. CHAPTER III: THEORY OF TRANSIENT RADIATION
S. Hanish 10 Mar. 1966 104 p refs
(NRL-1688; AD-631772) CFSTI: HC $4.00/MF $0.75

Contents: Poisson's solution of the initial value problem; Jordan's lemma; General formulas for the calculation of transient radiation; Transient radiation from a piston membrane—work of Kozina and Makarov; Transient response of a rigid piston in an infinite rigid baffle—work of Miles; Indicial impedance of a rigid piston in a rigid infinite baffle; Transient radiation field of a vibrating plate edge clamped in a rigid wall; Transient radiation from large aperture planar radiators—case of short waves; Rectangular 'large aperture radiator' illuminated by a step modulated sinusoidal signal; Rectangular 'large aperture radiator' illuminated by a rectangular pulse modulated sinusoidal signal; Transient radiation from spheres; The polynomials $B_n(jkr_o)$ and its Laplace inversions; Transient radiation from spheres excited by arbitrary time signals; Characteristic waves of exterior space; Transient excitation of spheres by a sinusoidally modulated step function; Ratio $R^{(k)}$ of initial velocity potential amplitude of transient waves to the velocity potential amplitude of steady state waves in the far field; Transient radiation from a spherical source of order n= 0 for an impulse excitation; Transient radiation from a spherical source of order n= 0 for step sinusoid excitation; Tail end of transient radiation from a spherical source of order n= 0; Tail end of transient radiation from a spherical source of order n= 1; Transient reaction of medium on a spherical radiator of order n= 1; Theory of sound radiation from moving sources; The transient field from an infinite line source of uniform strength; Transient waves in two dimensions—work of Barakat. TAB

N66-29221*# Ohio State Univ., Columbus.
A STUDY OF ELECTRODYNAMICS INVOLVING MOVING MEDIA
Li-jen Du 1966 117 p refs
(Grant NsG-448)
(NASA-CR-508) CFSTI: HC $4.00/MF $0.75 CSCL 20C

The electromagnetic field problems involving moving isotropic and lossless medium have been studied, based upon Minkowski's theory of electrodynamics of moving media. The analysis of the problem is facilitated by the use of the auxiliary functions known as potentials, which are introduced in a manner similar to that used for the stationary medium. Two problems are considered: the field expansions in and the parameters of the waveguide filled with medium moving uniformly along the direction of the axis of the guide, and the radiation field of a line source located above and parallel to a moving dielectric half-space. Author

N66-29237# Polytechnic Inst. of Brooklyn, N. Y.
EXPLICIT FORMS OF THE MATERIAL FUNCTIONS FOR CERTAIN NONLINEAR MATERIALS WITH MEMORY
T. Tang Wang Feb. 1966 41 p refs
(Contract Nonr-839(32)(FBM))
(PIBAL-912; AD-632002) CFSTI: HC $2.00/MF $0.50

The explicit restrictions on the forms of the kernels (materials functions) in Green and Rivlin's integral representation of the tensor-valued constitutive functionals are studied for certain classes of materials, namely, materials with no ageing effects, materials which exhibit no creep recoveries, and materials whose deformations are completely recoverable upon complete unloading. The results may be helpful in the experimental characterization of the non-linear viscoelastic materials. It is shown that for materials which do not exhibit aging effects the variables in each of the kernels should appear as the difference between the present and the past time variables. For materials with no creep recoveries the present time variable in the kernels of the creep integral laws must vanish. Finally, it is shown that for completely recoverable materials, if the limit of each kernel in the creep integral laws exists as the present time variable tends to infinity, then the limit should vanish identically. Procedures for experimental determination of the kernels for each class of materials are also discussed. Author (TAB)

N66-29262# Emmanuel Coll., Boston, Mass. Oriental Science Library.
A STUDY OF THE MAGNETIC PROPERTIES AND FERROMAGNETIC RESONANCE OF THE YTTRIUM-LANTHANUM IRON GARNET SYSTEM
Guo-Dong Li et al Bedford, Mass., AFCRL, Feb. 1966 25 p refs Transl. into ENGLISH from Wu-Li Hsueh-Pao (Peking), v. 19, no. 1, 1963 p 1-10
(Contract AF 19(628)-5073)
(EMM-65-11; AD-632403) CFSTI: HC $1.00/MF $0.50

This paper studies the magnetic properties and ferromagnetic resonance of the yttrium-lanthanum iron garnet system $Y_{3(1-x)}La_{3x}Fe_5O_{12}$ at compositions where x = 0, 0.5, 0.10, 0.20, 0.30, 0.50, 0.75 and 1.00. The single-phase region with the garnet structure determined by X-ray powder pattern analysis and metallographic observations extends to approximately $0.10 < x < 0.20$. However, magnetic and ferromagnetic resonance observations indicate a somewhat narrower single-phase region. The saturation magnetic moment per gram σ_s, initial permeability μ_0, coercive force H_c, effective g-factor g_{eff} and resonance line-width ΔH (at 3970 and 9160 Mc/sec) are measured as a function of the compositions. Variations in σ_s with composition and the magnitude of μ_0 as viewed from various magnetization mechanisms are discussed. From the frequency dependence of g_{eff}, the intrinsic g-factors and internal fields H_i of the materials are computed. Exponential dependence of ΔH, H_i and H_c on x in certain composition regions observed experimentally is interpreted from the viewpoint of magnetic inhomogeneity. Author (TAB)

N66-29288*# General Dynamics/Astronautics, San Diego, Calif.
GENERAL DYNAMICS/ASTRONAUTICS ZERO-G PROGRAM Final Report, May 1960-Mar. 1962
J. E. Sherley and F. Merino 15 Aug. 1962 113 p refs
(Contracts NAS8-2664; AF 18(600)-1775)
(NASA-CR-54998; AY-62-0031) CFSTI: HC $4.00/MF $0.75 CSCL 20D

A theoretical and experimental zero-gravity (zero-g) program was carried on in support of the Centaur Design and Development Program. The test results provided design criteria and design evaluation of a number of Centaur items. Both qualitative and quantitative zero-g data was obtained in the areas of liquid behavior, venting, heat transfer and instrumentation. An indirect result of the test program was the development of zero-g testing methods which will produce quality results, and the knowledge gained in handling of cryogenic liquids in this special environment. It is felt that this latter consequence of the test program will be very useful in planning future zero-g test programs. The experimental program consisted of laboratory, aircraft and ballistic missile tests. C-131B and KC-135 aircrafts, and Aerobee missiles were used. Author

N66-29308# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
MEASUREMENT OF THE COMPLEX DIELECTRIC CONSTANT OF PLEXIGLASS AT 35 KMC/S [MISURA DELLA COSTANTE DIELETTRICA COMPLESSA DEL PLEXIGLASS A 35 KMC/S]
M. Grandolfo and P. L. Indovina 7 Mar. 1966 36 p refs In ITALIAN; ENGLISH summary
(ISS-66/9) CFSTI: HC $2.00/MF $0.50

The measurement of the complex dielectric constant of plexiglass for frequencies ranging from 33 to 37 Kmc/s, is described. The experimental results were obtained using a microwave bench working with rectangular guides, by the method developed by S. Roberts and A. von Hippel. In particular, the numerical analysis of the experimental results was performed using the approximate formulae of T. W. Dakin and C. N. Works. The experimental results are presented and are compared to those already known for lower frequencies. Author

N66-29352*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DESIGN, CONSTRUCTION, AND PERFORMANCE OF CRYOGENICALLY COOLED AND SUPERCONDUCTING ELECTROMAGNETS
James C. Lawrence and Willard D. Coles [1965] 16 p refs Presented at the Intern. Symp. on Magnet Technol.; Sponsored by Stanford Univ., Calif., 8-10 Sep. 1965
(NASA-TM-X-52121) CFSTI: HC $1.00/MF $0.50 CSCL 20C

The design, construction, and testing of cryogenically cooled and superconducting electromagnets of large volume for research in plasma physics, solid state physics, and MHD power generation is discussed. One system of coils, wound from ultrapure aluminum and cooled with liquid neon, has produced steady-state fields as large as 200 kG in an 11.2 cm bore and 80 kG in a 30 cm bore. Superconducting coils have been wound from niobium-zirconium and niobium-tin wires and ribbons. These have produced fields as intense as 50 kG with niobium-zirconium coils and 80 kG with niobium-tin coils in a 10 cm bore. The performance of these coils, by themselves and in combination, to produce magnetic bottles with superimposed cusp fields is described. Author

N66-29442*# Northwestern Technological Inst., Evanston, Ill.
ON NONCONSERVATIVE STABILITY PROBLEMS OF ELASTIC SYSTEMS WITH SLIGHT DAMPING
G. Herrmann and I. C. Jong [1964] 35 p refs
(Grant NsG-605)
(NASA-CR-60703) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A linear two-degree-of-freedom system with slight viscous damping and subjected to nonconservative loading is analyzed

with the aim of studying the effects of damping on stability of equilibrium. It is found that in such systems multiple ranges of stability and instability may exist in a richer variety than in corresponding systems without damping. Further, for certain systems, instability either by divergence (static buckling) or by flutter may occur first as the compressive load increases, depending upon the ratio of the damping coefficients in the two degrees of freedom. It is shown finally that systems exist for which the destabilizing effect of slight viscous damping cannot be completely removed whatever the ratio of the (positive) damping coefficients. Author

N66-29476*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXTRATERRESTRIAL APPLICATION OF X-RAY DIFFRACTION
H. K. Herglotz 20 Apr. 1966 46 p refs
(NASA-TM-X-53449) CFSTI: HC $2.00/MF $0.50 CSCL 20F

X-ray diffraction provides information about elemental composition and can identify many compounds and minerals. It is, therefore, a promising candidate for the exploration of surfaces of the moon and earth-like planets if apparatus meeting the requirements of this extraterrestrial application can be developed. The fundamentals of X-ray diffraction are described and the difficulties connected with their space application are discussed. Hardware, either specifically designed for space exploration or adaptable for this purpose, are reviewed. Author

N66-29477*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
MEASUREMENT OF NEUTRON SPECTRA IN LIQUID HYDROGEN Quarterly Progress Report, Period Ending Mar. 17, 1966
G. D. Trimble and G. K. Houghton 7 Mar. 1966 70 p refs
(Contract NAS3-6217)
(NASA-CR-54977; GA-7064) CFSTI: HC $3.00/MF $0.75 CSCL 20M

This report describes work performed during this period on the measurement of neutron spectra in liquid hydrogen. Progress is discussed on the liquid hydrogen facility, the water cooled isotropic fast neutron source, fast neutron source monitors, the probe tube alignment mechanism, the background plug used for the thermal neutron spectrum measurements, theoretical calculations of neutron spectra, and neutron spectrum measurements by time-of-flight techniques. R.N.A.

N66-29523*# Illinois Univ., Urbana. Coordinated Science Lab.
COORDINATED SCIENCE LABORATORY PROGRESS REPORT FOR DECEMBER 1965, JANUARY, AND FEBRUARY 1966
1 Apr. 1966 151 p refs
(Grants NsG-443; NsG-504; NSF GK-36; Contracts DA-28-043-AMC-00073(E); Nonr-3985(08) et al)
(NASA-CR-75869; AD-631712) CFSTI: HC $5.00/MF $1.00 CSCL 20D

Studies of mechanical damping in possible gyro materials are reported along with studies of micrometeorite influence and the optimal choice of gyro diameter. Measurements of the scattering of electrons from the (100) surface of tungsten are reported. These measurements are interpreted in terms of the excitation of the vibrational states of surface atoms and in terms of the band structure. The experiments for the measurement of the angular distribution of particles scattered from surfaces and for the study of the adsorption-desorption kinetics of gases at surfaces are continuing. The status of these experiments is given. Several results were obtained in the continuing projects on the sensitivity problem, stability of nonlinear systems, optimization of systems with fixed control structure, and computer-oriented formulation of the optimal control problem. Bounds were obtained for sensitivity functions. Optimum regulator systems were found to be relatively insensitive. Some extensions of Popov's criterion were derived. Author

N66-29533# European Atomic Energy Community, Brussels (Belgium).
MEASURINGS OF OPTICAL CONSTANTS BY ELLIPSOMETRIC METHOD [MESURES DES CONSTANTES OPTIQUES PAR LA METHODE ELLIPSOMETRIQUE]
E. Landais and A. Manara Apr. 1966 22 p refs In FRENCH; ENGLISH summary
(EUR-2774.f) CFSTI: HC $1.00/MF $0.50

After Drude's early work, several methods have been developed for measuring the optical constants of materials. One of these methods, based on ellipsometric techniques, is described in the following. The experimental set-up involves sources, monochromator, polarizing systems, goniometer, and crystal holders, all assembled into a precision optical bench which has been realized in our laboratories. The detection and measuring systems are also described. In the end, a discussion is given concerning the practical limits of accuracy of the apparatus. Author

N66-29555# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
COUPLING AND RECOUPLING OF RELATIVISTIC STATES. III: ON THE TRANSITIONS BETWEEN FRAMES OF DECOMPOSITION AND ASSOCIATED COVARIANCE
Haim Goldberg 1 Apr. 1966 14 p refs
(Contract AT(30-1)-875)
(UR-875-135)

The freedom in the way relativistic covariance is applied to elastic scattering matrix elements is further discussed. The change in the definition of the two invariants associated with change of the frame of decomposition (FD) is calculated, as well as the induced transformation of the reduced matrix elements $A(w_3w_4; Lmab)$. It is suggested that these matrix elements fulfill some partial differential equations covariant under arbitrary change of the FD. One particular example is discussed, and happens to be compatible with the experimental situation. Author

N66-29692# Navy Underwater Sound Reference Lab., Orlando, Fla.
ANALYSIS OF ACOUSTIC IMPEDANCE DATA
Gerald A. Sabin 5 May 1966 17 p refs
(USRL-RR-81; AD-632075) CFSTI: HC $1.00/MF $0.50

Procedures and applicable charts for the analysis of acoustic impedance data obtained from the USRL pulse tube are presented. Formulas and tables for rapid determination of the bilinear transformation $(1+r)/(1-r)$ are shown. Author (TAB)

N66-29870*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE DISPLACEMENTS IN AN ELASTIC HALF-SPACE DUE TO A MOVING CONCENTRATED NORMAL LOAD
Donald L. Lansing Washington, NASA, Jul. 1966 65 p refs
(NASA-TR-R-238) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Equations are derived for the steady-state displacements produced at any point within an elastic half-space by a concentrated normal load in uniform motion over the surface. The results are valid for all depths, load speeds, and elastic constants. The equations for the displacements produced on the surface and in the vertical plane containing the line of motion of the load for the special case of Poisson's ratio equal to 1/4 are obtained from the general results and are expressed in terms of elementary functions and elliptic integrals. Some numerical calculations based upon these equations are presented and discussed for a wide range of load speeds. In addition, the complete time-dependent equations for the horizontal displacements produced at the surface, including the transients excited by the initial application of the load, are derived.
Author

N66-29889# Naval Research Lab., Washington, D. C.
HYPERVELOCITY CAPABILITY AND IMPACT EFFECT PROGRAM Final Report
H. F. Swift and J. R. Baker Mar. 1966 61 p refs
(ARPA Order 70)
(NRL-1677; AD-631957) CFSTI: HC $3.00/MF $0.75

Two approaches to the development of high performance accelerators were investigated. The first approach utilized pulses of electrical energy to heat small chambers of low molecular weight gas to high pressures. The maximum projectile velocities attained from the expansion of this gas did not exceed the velocities which were concurrently being achieved with compression type light-gas guns. The second approach was a continuance of the development of the conventional light-gas gun utilizing gas heating techniques and optimization of gun parameters. Comparisons are made between real gas and ideal gas on the effects of gas temperature and pressure of sound speed, efflux velocity, and maximum flow velocity for steady and nonsteady conditions. At peak gas pressures (above 6.8 kilobars) the performance of a light-gas gun could be increased by decreasing the temperature profile of the driver gas. All attempts to increase maximum projectile velocities in optimized NRL light-gas guns by preheating the driver gas were unsuccessful. Author (TAB)

N66-29901# Marine Engineering Lab., Annapolis, Md.
THE DEVELOPMENT OF CHROMATICITY REFERENCES FOR CONSOLE SIGNAL LIGHTS
Robert L. Booker and George K. C. Hardesty Apr. 1966 24 p refs
(MEL-91/66; AD-632603) CFSTI: HC $1.00/MF $0.50

This report deals with the development of 20 colored plastic reference filters for which chromaticity coordinates, luminous efficiencies, and radiant transmittance are given. These filters can be used in conjunction with the mel color demonstrator to demonstrate chromaticity limits visually, and they can be used to help color-correct individual brightness photometers. Author (TAB)

N66-29972*# ITT Federal Labs., San Fernando, Calif.
STUDY OF PROPAGATION OF COHERENT RADIATION AT VISIBLE OR NEAR VISIBLE WAVELENGTHS THROUGH THE ATMOSPHERE Interim Report, Oct. 1963–Oct. 1964
John M. Grant Oct. 1964 59 p refs
(Contract NAS8-11103)
(NASA-CR-76078) CFSTI: HC $3.00/MF $0.50 CSCL 20F

The degree of coherence for optical beams traversing a fluctuating medium is derived in terms of the correlation coefficient of the atmosphere. Under certain specific conditions, it is shown that the degree of coherence is determined solely by one atmospheric parameter, the mean square angular fluctuation of a ray. The degree of coherence of laser beams traversing artificially created fog atmospheres within the ITTFL optical tunnel has been measured by the two-pinhole interferometric technique. The results obtained are in good agreement with the theoretical predictions. Based on this work, the aperture limitation, imposed by the atmosphere, on an optical heterodyne receiver is predicted. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-28386# Argonne National Lab., Ill.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON WEAK INTERACTIONS, OCTOBER 25–27, 1965
[1965] 473 p refs
(Contract W-31-109-ENG-38)
(ANL-7130) CFSTI: HC $4.75/MF $2.00

Conference papers on CP violations, experimental data on K-decays, special features of strange particle decays, accelerator neutrinos and intermediate bosons, and strangeness-conserving beta decay are presented. For individual titles see N66-28387–N66-28416.

N66-28387# Princeton Univ., N. J. Palmer Physical Lab.
THE TRANSVERSE POLARIZATION OF THE MUON IN THE DECAY $K_L^0 \rightarrow \mu^+ + \pi^- + \nu$
D. Bartlett, C. Friedberg, K. Goulianos, and D. Hutchison *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 3–12 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00
(Contract Nonr-1858(06))

Scintillator counters were used to distinguish electrons emitted from muons during neutral kaon decay under transverse polarization conditions. Asymmetric values were obtained by analyses of 28,000 events in which two particles from a beam of kaon mesons entered the apparatus, one stopped and subsequently decayed. Muon polarization was found by multiplication of the experimental asymmetry with a factor incorporating the following three primary effects: (1) The expected ratio (forward–backward)/(forward+backward) of the decay electron from the polarized muon; (2) dilution of the polarization by a factor of 2.8 ±0.6 from unpolarized and partially polarized sources; and (3) accidental and neutron induced events amounting to 23 ±6%. Combination of all these effects resulted in a polarization value of −0.03 ±0.08. G.G.

N66-28388# Maryland Univ., College Park.
TIME REVERSAL INVARIANCE IN $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$
R. G. Glasser, B. Kehoe, P. Engelmann, H. Schneider (Heidelberg Univ.), C. Alff, and Larry L. Kirsh (Columbia Univ.) *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 13–16 (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

An experiment is suggested for investigating the time reversal invariance of the electromagnetic interaction by studying the polarization of Λ in the Dalitz decay of the Σ hyperon: $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ NSA

N66-28389# Princeton Univ., N. J. Palmer Physical Lab.
EXPERIMENTAL STATUS OF CP VIOLATION
James W. Cronin *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 17-28 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00
(Contract Nonr-1858(06))

A brief survey of CP noninvariance experiments was made in an attempt to make a systematic analysis required to characterize in a phenomenological way the CP violating effect in $K_2^0 \rightarrow \pi^+\pi^-$. NSA

N66-28390# Institute for Advanced Study, Princeton, N. J.
PHENOMENOLOGICAL DESCRIPTION OF K DECAY
C. N. Yang *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 29-45 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

Phenomenological aspects of the kaon-anti kaon decay were discussed by describing the matrix elements of a decay system with a charged parity noninvariance. For the leptonic modes K_{e3} and $K_{\mu 3}$, the decay matrix was split and the CP nonvariance was utilized to explain a slight difference in decay rates as well as the difference between the Dalitz plots for the two decays. G.G.

N66-28391# Brookhaven National Lab., Upton, N. Y.
$K_2^0 \rightarrow \pi^+ + \pi^- \pi^0$ DECAY
P. Guidoni, V. Barnes, H. W. Foelsche, G. R. Kalbfleisch, G. W. London, K. Lai et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 49-58 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The branching ratio and the spectrum of the K_2^0 decay into positive, negative, and neutral pions was studied in a hydrogen bubble chamber by K_2^0 meson beam incident on an aluminum target. Experimental data showed agreement with earlier work and gave a good phenomenological fit to a straight line with a slope compatible with photon decay. G.G.

N66-28392# Ecole Polytechnique, Paris (France).
MEASUREMENT OF THE RATE OF K_2^0 DECAY INTO THREE PIONS AND TEST OF CP INVARIANCE
L. Behr, V. Brisson, P. Petiau, C. Pascaud, B. Aubert, E. Bellotti et al (Milan Univ.) *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 59-66 (See N66-28386 16-24) CFSTI: HC $4.00/MF $2.00

The three pion decay modes of the K_2^0 were investigated for the determination of the absolute rates $\Gamma_2(+-0)$ and $\Gamma_2(000)$. The experiment was performed with a K^+ beam from the CERN PS in the Ecole Polytechnique heavy liquid bubble chamber. The decay rates are given by $\Gamma_2(+-0) = N(\pi^+\pi^-\pi^0)/T$ and $\Gamma_2(000) = N(\pi^0\pi^0\pi^0)/T$ where $N(3\pi)$ is the number of observed events corrected for detection and scanning efficiency and T is the total observable time of flight of all K_2^0's inside the fiducial volume taking into account the attenuation of the K_2^0 flux by decay and interaction. A test for CP invariance is briefly discussed. NSA

N66-28393# Vanderbilt Univ., Nashville, Tenn.
THE DECAY $K_2^0 \rightarrow \pi^+ \pi^- \pi^0$
H. W. K. Hopkins, T. C. Bacon, and F. R. Eisler (Rutgers Univ.) *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 67-75 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The experimental results of a study of the decay $K_2^0 \rightarrow \pi^+\pi^-\pi^0$ are presented. A discussion of the results is included. NSA

N66-28394# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PRELIMINARY RESULTS ON THE CHARGED DECAY MODES OF K_2^0
P. Basile, J. Bingert, J. W. Cronin, B. Thevenet, R. Turlay, S. Zylberach et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 77-81 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The decay modes $\pi e \nu$, $\pi \mu \nu$, $\pi^+\pi^-\pi^0$, and $\pi^+\pi^-$ of K_2^0 were investigated. The preliminary experimental results are presented. NSA

N66-28395# Illinois Univ., Urbana. Dept. of Physics.
THE ENERGY DEPENDENCE OF THE VECTOR FORM FACTOR IN THE K_{e3}^0 DECAY
G. P. Fisher, A. Abashian R. J. Abrams, D. W. Carpenter, B. M. K. Nefkens, J. H. Smith et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 83-90 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The experimental results on K_{e3}^0 decays are presented. In particular, the decay $K_{e3}^0 \rightarrow \pi^\pm + e^+ + \nu$ was investigated to study the energy dependence of the vector form factor of the weak interactions. The results are discussed. NSA

N66-28396# Illinois Univ., Urbana. Dept. of Physics.
SPARK CHAMBER MEASUREMENT OF THE $K_{\mu 3}^0$ DECAY SPECTRUM
D. W. Carpenter, A. Abashian, R. J. Abrams, G. P. Fisher, B. M. K. Nefkens, and J. H. Smith *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 91-105 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The experimental technique for obtaining the $K_{\mu 3}^0$ decay spectra using a spark chamber is outlined. A fit of the data to constant form factors, J=1 intermediate state, and linearly varying form factors is discussed. Charge asymmetry and neutral currents are discussed. NSA

N66-28397# Pennsylvania Univ., Philadelphia.
K_{e2}^+ BRANCHING RATIO
D. R. Bowen, A. K. Mann, W. K. Mc Farlane, A. D. Franklin, E. B. Hughes (Princeton Univ.) et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 107-113 (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

An attempt was made to detect the $K^+ \rightarrow e^+ + \nu$ (K_{e2}^+) decay mode using spark chamber and counter techniques. The pure leptonic decays of the charged π and K mesons provide stringent tests of the (V−A) theory of weak interactions. Thus the agreement between the predicted ratio of rates for the decays $\pi^+ \rightarrow e^+ + \nu$ and $\pi^+ \rightarrow \mu^+ + \nu$ and the observed ratio was investigated. NSA

N66-28398# California Univ., Berkeley. Lawrence Radiation Lab.
K DECAY
George H. Trilling *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 115-149 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

Quantitative results on the decays of K mesons are reviewed. Data were summarized by combining equivalent experimental techniques and analyses, and by assigning proportional weights to their statistics. Any detailed considerations of the $\Delta S=\Delta Q$ selection rule, K_1-K_2 mass difference, and charged parity violation were omitted. Tables contain K^+ rates, K^0 rates, data for K^0_2 rate determinations, rate comparisons for K decay into triple pion modes, measurements of odd pion spectra in K triple pion decay mode, Ke_3 decay, and $K^+\mu_3$ decay measurements. G.G.

N66-28399# Ecole Polytechnique, Paris (France).
TIME DISTRIBUTION OK K^0 LEPTONIC DECAYS
B. Aubert, L. Behr, L. M. Chounet, J. P. Lowys, and C. Pascaud *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 153–157 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The time distribution of 315 $K^0 \rightarrow \pi e\nu$ was studied in the Ecole Polytechnique heavy liquid bubble chamber. Only electronic decays where the electron was directly recognized (stopping in the chamber) were used. This experiment measures the number of events N^+ (t) $K^0 \rightarrow \pi^- e^+ \nu$ and N^- (t) $K^0 \rightarrow \pi^+ e^- \nu$, as a function of time. These distributions provide a test of $\Delta S = \Delta Q$ selection rule. If one observes a violation of this rule, then one is able to test PC conservation in electronic K^0 decays. The results are discussed. NSA

N66-28400# Yale Univ., New Haven, Conn.
SELECTION RULES IN LEPTONIC DECAY
W. J. Willis *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 159–188 refs (See N66-28386 16-24) CFSTI: $4.75/MF $2.00

The experimental status of a number of proposed selection rules in leptonic decays is reviewed. In particular, neutral leptonic currents, $\Delta S = \Delta Q$, $|\Delta S| < 2$, second class currents, and octet currents are discussed. The K_{e4} decays are discussed. NSA

N66-28401# Brookhaven National Lab., Upton, N. Y.
HYPERON NON-LEPTONIC DECAYS
N. P. Samios *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 189–214 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The non-leptonic hyperon decays are reviewed, and the relevance of experimental data concerning parity conserving and parity non-conserving amplitudes as well as transformation properties of the decay interactions are discussed. It was concluded that all tests on hyperon non-leptonic decays satisfied the theoretical predictions quite well and that the accumulation of more Ω^- decays will allow further checks of the $\Delta I = 1/2$ and $|\Delta S| \leq 1$ rules. G.G.

N66-28402# Institut des Hautes Etudes Scientifiques, Paris (France).
K_1-K_2 MASS DIFFERENCE AND K_1 REGENERATION
Myron L. Good *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 215–230 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The experimental situation regarding the magnitude and sign of the K_1-K_2 mass difference is reviewed. K_1-K_2 regeneration experiments are discussed from the viewpoint of attempting to learn from them as much as one can about the weak interactions. In particular, CPT tests are discussed. NSA

N66-28403# Columbia Univ., New York.
SEARCH FOR INTERMEDIATE BOSONS IN PROTON-NUCLEON COLLISIONS
R. Burns, G. Danby, E. Hyman, L. M. Lederman, W. Lee, J. Rettberg (Brookhaven Natl. Lab.) et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 233–246 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

Measurements on the yield of high energy muons, emitted at large angles to a beam of 20 BeV/c and 30 BeV/c protons, were made to set up an upper limit to the production of massive unstable states decaying into muons with emphasis on the intermediate boson W. The results based upon a statistical confidence level of $\geq 99\%$ are presented in a table. It was found that the 20 BeV/c run was reasonably sensitive to 4-BeV bosons and that the 30 BeV/c run extended to a mass of 6 BeV. G.G.

N66-28404# Argonne National Lab., Ill.
SEARCH FOR INTERMEDIATE VECTOR BOSON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS
R. C. Lamb, R. A. Lundy, T. B. Novey, D. D. Yovanovitch, M. L. Good, R. Hartung (Wisconsin Univ.) *In its* Proc. of the Intern. Conf. on Weak Interactions [1965] p 247–256 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

An experiment was conducted to detect intermediate vector boson production in nucleon–nucleon interactions sensitive to W masses in the range of 2 to 3 BeV. Magnetic spectrometer observation of a 12.5 BeV/c proton beam incident on a 3 in. long uranium target did not detect muon signals in excess of those due to pion and kaon decay. The number of effective nucleons in the uranium nucleus was estimated assuming an $A^{2/3}$ dependence. G.G.

N66-28405# European Organization for Nuclear Research, Geneva (Switzerland).
ν AND $\bar{\nu}$ INTERACTIONS IN A HEAVY LIQUID BUBBLE CHAMBER
In Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 257–271 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The CERN ν and $\bar{\nu}$ experiments and preliminary results are briefly discussed with respect to phenomenological account of $\bar{\nu}$–run, the elastic process: $\nu + n \rightarrow \mu^- + p$ and $\bar{\nu} + p \rightarrow \mu^+ + n$, and a comparison of the single pion events with the $N_{33}(1238)$ production model. NSA

N66-28406# Oxford Univ. (England).
HIGH ENERGY NEUTRINO EXPERIMENTS AT ACCELERATORS
D. H. Perkins *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 273–284 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

Some of the problems of weak interaction physics which one might hope neutrino experiments to answer, and the improvements in experimental conditions needed to answer them, are discussed using the situation at CERN/BNL 1963/64 as a basis. The state of the existing experimental data is discussed only briefly. Finally, a brief description is given of the programs of beam improvement, machine development and giant chambers which are needed to obtain the necessary increase in event rate. NSA

N66-28407# Harvard Univ., Cambridge, Mass.
HIGH ENERGY SEMILEPTONIC REACTIONS
Stephen Adler *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 285–309 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The theory of semileptonic interactions, as it pertains to high-energy neutrino experiments, is discussed. Tests of CP invariance in high-energy semileptonic weak interactions are considered, as well as tests of the postulates of the theory. NSA

N66-28408# Yale Univ., New Haven, Conn.
THE MOMENTUM DEPENDENCE OF THE HELICITY OF BETA PARTICLES
J. S. Greenberg and D. M. Lazarus *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 313–325 refs Sponsored in part by NSF (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The results of a Mott scattering analysis of the momentum dependence of the helicity in the allowed Gamow–Teller transition in Co^{60} are presented. A velocity range of 0.7 to 0.4C was covered. The experimental technique was discussed in relation to V–A theory. NSA

N66-28409# United Kingdom Atomic Energy Authority, Harwell (England).
AN APPARENT SMALL ANOMALY IN THE FT VALUE OF A SUPERALLOWED FERMI TRANSITION
Joan M. Freeman, J. G. Jenkin, G. Murray, and W. E. Burcham (Birmingham Univ.) *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 327–332 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The β end-point energy and the half life of the ^{26m}Al $(\beta^+)^{26}Mg$ decay were measured, and the ft value for the transition was calculated. The ft value obtained was in exact agreement with the previous value, but was significantly lower than the mean ft value for some other β^+ transitions between $J=0^+$, $T=1$ isobars. NSA

N66-28410# Brookhaven National Lab., Upton, N. Y.
INDICATION OF PARITY MIXING IN AN ELECTROMAGNETIC TRANSITION
G. Scharff-Goldhaber and M. Mc Keown *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 333–336 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

An investigation of the parity-forbidden M1 component of the 57-kev transition in ^{180}Hf was made. A brief outline of the results is presented. NSA

N66-28411# Chicago Univ., Ill.
WEAK INTERACTIONS OF NON-STRANGE PARTICLES
V. L. Telegdi *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 337–371 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The CVC theory is briefly discussed in terms of obtaining the value of G^β, weak magnetism, and forbidden Fermi transitions. The ratio $G^\beta/G^{\beta=\psi}$ is discussed in terms of weak parity violating forces between nucleons. A few experiments are outlined. The application of elementary particle concepts to the β decay of complex nuclei is reviewed. Muon decay is briefly discussed. NSA

N66-28412# Case Inst. of Tech., Cleveland, Ohio.
THE CASE-WITWATERSRAND UNDERGROUND NEUTRINO PROGRAM
M. F. Crouch, H. S. Gurr, T. L. Jenkins, W. R. Kropp, F. Reines, G. R. Smith et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 373–392 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The status of the Case–Wits deep underground experimental program which is aimed primarily at the study of neutrinos arising from the interaction of cosmic rays with the atmosphere and secondarily at neutrinos from the sun is reported. Preliminary results taken are presented. NSA

N66-28413# Utah Univ., Salt Lake City.
COSMIC RAY NEUTRINOS
J. W. Keuffel *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 393–405 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

Experiments which are presently being done in the high-energy cosmic-neutrino field are outlined. The type of data which may be expected in the immediate future is discussed. The University of Durham–Tata Institute–Osaka City University collaboration experiment in the Kolar Gold Fields in India is discussed. Brief mention is made of the University of Utah detector now in the prototype testing stage. NSA

N66-28414# Stanford Univ., Calif. Linear Accelerator Center.
RECENT WORK ON THE RENORMALIZATION OF THE WEAK AXIAL-VECTOR COUPLING CONSTANTS
William I. Weisberger *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 409–420 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The calculations which seem to give a successful explanation of the ratio of axial-vector to vector coupling constants measured in neutron β-decay are discussed. The assumptions used in the derivation are: (1) The vector and axial-vector currents measured in the weak interactions obey the equal-time commutation rules of SU(3)×SU(3) as proposed by Gell-Mann; and (2) The axial-vector current is partially conserved, which is a basis for deriving such results as the Goldberger–Treiman relation. NSA

N66-28415# Pennsylvania Univ., Philadelphia.
SU(3) AND NONLEPTONIC WEAK INTERACTIONS
Benjamin W. Lee *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 421–429 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The approximation of CP invariance is used to discuss nonleptonic weak interactions. NSA

N66-28416# Columbia Univ., New York.
THEORETICAL REMARKS ON CP NON-INVARIANCE
T. D. Lee *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Weak Interactions [1965] p 431–437 refs (See N66-28386 16-24) CFSTI: HC $4.75/MF $2.00

The observed charged parity violation in the K_2^0 decay was analyzed for the case that the final eigen-state H_γ is non-invariant under particle anti-particle conjugation. An extensive study found no evidence that the final hadron eigen-state of the non-leptons is, or is not, invariant under charge. If the charge distribution ≠ particle anti-particle conjugation, then the observed charge parity non-invariance was attributed either to violation of the charge conjugation by the initial hadron eigen state or to violation by the final hadron eigen-state. G.G.

N66-28518*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

COLLISION FREQUENCIES AND ENERGY TRANSFER-IONS Scientific Report No. 272

Peter M. Banks 15 May 1966 43 p refs

(Grant NsG-134-61)

(NASA-CR-75640) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Ion collision frequencies and energy transfer for conditions of gaseous thermal nonequilibrium have been investigated. The problems of ion-neutral and ion–ion elastic collisions have been considered under the assumption of separate Maxwellian velocity distributions. Expressions for the nonequilibrium momentum transfer cross sections, collision frequencies, and energy transfer rates are given for neutral gases on the basis of a polarization potential and for ions on the basis of the Coulomb interaction. Next, the problem of ion-neutral resonance charge exchange is introduced in its effect upon collision cross sections and ion energy transfer rates. An analysis is made of gathered laboratory data to arrive at suitable expressions for the resonance charge exchange and momentum transfer cross sections for H^+, O^+, He^+, N_2^+, and O_2^+. Using these results, resonance charge exchange and momentum transfer collision frequencies are derived. The resonance ion-neutral energy transfer rates are then compared with expressions used in previous studies of ion temperatures. Author

N66-28522# Naval Research Lab., Washington, D. C. Theory Branch.

ON THE RELATIVISTIC TRANSFORMATION OF SPIN

I. Manning *In its* Rept. of NRL Progr. Feb. 1966 p 6–9 refs (See N66-28520 16-23) CFSTI: $1.25

The total angular momentum of a relativistic system is a well-defined concept, but the separation of the momentum into its spin and orbital parts, as illustrated by a Direc electron field, is not well-defined. The new definition of spin is intuitively attractive, but it does not employ the usual quantities or transform as a Lorentz vector. A conglomerate of point particles as a mechanical model is considered in which the definition of spin corresponds to the total angular momentum about the center of energy. The unusual transformation properties of this definition arise from the correlation between a shift in the particle's center of energy and a change in its velocity. Author

N66-28556# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.

GAMMA RAY PRODUCTION CROSS SECTIONS

W. E. Edwards 26 Aug. 1965 51 p refs

(Contract AT(40-1)-2847)

(GEMP-360, Suppl. 1)

Gamma ray production cross sections are presented as a function of 15 neutron lethargy groups and 11 photon energy groups for 15 elements and isotopes. These cross sections account for the production of gamma rays by neutron radiative capture, neutron inelastic scattering, neutron induced fissioning, and (n,α) reactions. Author

N66-28570# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

THE MU-COMPONENT IN AN ELECTROMAGNETIC CASCADE [MIONY W KASKADZIE ELEKTROMAGNETYCZNEJ]

J. Wdowczyk *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 54–99 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Mu-components are tabulated for various energies and discussed in terms of an electromagnetic cascade. Two variations of a formula are presented and calculation methods are described. Density spectra are determined for the mu-components in an electromagnetic wave. Transl. by M.W.R.

N66-28571# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

THE SPECTRUM OF HIGH ENERGY PHOTONS PRODUCED ACCORDING TO HAYAKAWA'S HYPOTHESIS [WIDMO FOTONOW WYSOKIEJ ENERGII WYNIKAJACE Z HIPOTEZY HAYAKAWY]

W. Tybor *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 100–104 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

A model, based on Hayakawa's hypothesis, is proposed for the determination of the spectra of high energy primary photons in atmospheric cosmic ray showers. The role of electromagnetic cascades in energy spectra of primary photons is discussed, and data to verify the hypothetical model are presented. Transl. by M.W.R.

N66-28572# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

ENERGY LOSSES OF MUONS OF SUPER HIGH ENERGY CAUSED BY THE ELECTROMAGNETIC INTERACTIONS [STRATY ENERGII MIONOW O NAJWYZSZEJ ENERGII WYWOLANE ODDZIALYWANIAMI ELEKTROMAGNETYCZNYMI]

A. D. Erlykin *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 105–117 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Two formulas are presented for determining the energy spectrum of muons at sea level. Radiation loss in free electrons is found through absorption measurements of these ultrahigh energy particle interactions. Transl. by K.W.

N66-28573# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

FACTORS DETERMINING THE MUON SPECTRUM IN ORDINARY NUCLEAR EAS [CZYNNIKI WYZNACZAJACE WIDMO MIONOW W ZWYKLYCH PEKACH]

J. Gawin *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 119–132 (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Fluctuations in the density spectra of muon components in ordinary radioactive atmospheric showers are discussed. Attention is given to the penetrating components in cosmic ray showers, the changing direction of cloud structures, and the wave damping which occurs. Transl. by K.W.

N66-28574# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

LOW ENERGY NUCLEAR ACTIVE PARTICLES IN EAS [NISKOENERGETYCZNE CZASTKI JADROWO CZYNNE W WIELKICH PEKACH]

T. W. Danilowa *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 133–139 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

The number and distribution of low energy radioactive particles is cosmic ray showers is discussed, and attention is also given to high energy particle spectra. The resultant $N_{\gamma-e}$ from N is considered, as are half-number charges.

Transl. by K.W.

N66-28577# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

RECORDING OF THE PENETRATING PARTICLES COMPONENT, TAKING ACCOUNT OF THE SECONDARY INTERACTION OF THE NUCLEAR ACTIVE PARTICLES AND MUONS IN THE ABSORBER [REJESTRACJA SKLADOWEJ PRZENIKLIWEJ Z UWGLEDNIENIEN WTORNYCH ODDZIALYWAN CZASTEK JADROWO CZYNNYCH I MIONOW W ABSORBENCIE]

J. Hibner *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 159–194 (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Counters for detecting the penetration of radiation components are investigated, and consideration is given to secondary interactions caused by radioactive particles and muons in the absorber. Transformation of histograms is discussed, as is the experimental arrangement of various geometric configurations. Numerous graphs are included. Transl. by M.W.R.

N66-28579# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

INVESTIGATION OF THE HIGH ENERGY MUONS IN AN UNDERGROUND IONIZATION CALORIMETER [BADANIE MIONOW WYSOKIEJ ENERGII W PODZIEMNYM KALORYMETRZE JONIZACYJNYM]

A. D. Erlykin *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 205–213 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

An ionization calorimeter located 10 feet underground is used to study high energy particles, particularly muons, from upper atmospheric cosmic ray showers. Formulas are included for the determination of the complex cycles of atmospheric radiation emission for data obtained at a high altitude experimental physics institute. Transl. by M.W.R.

N66-28581# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

SOME PARAMETERS ON NEON TUBES HODOSCOPE IN CONSTRUCTION [NIEKTORE PARAMETRY BEDACEGO W BUDOWIE HODOSKOPU ZLOZONEGO Z RUREK NEONOWYCH]

J. Jatczak *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 227–246 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

A neon-tube hodoscope is considered for the determination of trajectories of high atmospheric cosmic ray showers. The detection of ionized radiation showers is aided by aluminum-electrodes within the optical instrument. Parameters used in the construction of the hodoscope are discussed. Transl. by M.W.R.

N66-28583*# National Aeronautics and Space Administration, Washington, D. C.

YIELD MEASUREMENTS ON COLLISION OF SLOW ELECTRONS WITH INERT GAS ATOMS [AUSBEUTEMESSUNGEN BEIM STOSS LANGSAMER ELEKTRONEN MIT EDELGASATOMEN]

H. Maier-Leibnitz Jun. 1966 41 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 95, 1935 p 499–523 (NASA-TT-F-10171) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The excitation of helium, neon, and argon by electron collision is investigated by an electric multiple collision method. Two procedures are described for measuring, at low electron velocities, the total yield during a collision, i.e., the excitation probability of all terms, with sufficient accuracy. The results on total yield are practically free of instrument errors and have an accuracy of 20%. Excitation and ionization yields were separated by ionization probability measurements. Yields of several percent were obtained. Various statements are made on the excitation functions of individual terms. Rather sharp maxima of yield are obtained within one volt above the excitation potential. Author

N66-28604# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

SYMMETRY PROPERTIES OF THE 3j-SYMBOLS FOR SU(3)

Jean-Robert Derome Mar. 1966 14 p refs (TH-138) CFSTI: HC $1.00/MF $0.50

For an arbitrary compact group it is not in general possible to choose the 3j-symbol $(j_1 j_2 j_3)_{r\text{-}m_1 m_2 m_3}$ such that its absolute value is invariant under every permutation of the j's and of the corresponding m's. Still, it is commonly assumed that for SU(3) such a choice is possible. In this paper, it is shown that this assumption is indeed justified. Author

N66-28644# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

PRODUCTION OF A_1, A_2 AND B MESONS IN HIGH-ENERGY $\Pi \pm$ p INTERACTIONS

Thomas Ferbel 15 Feb. 1966 11 p refs (Contract AT(30-1)-875) (UR-875-123) CFSTI: HC $1.00/MF $0.50

Data available on the two reactions $\pi^{\pm} + p \rightarrow \pi^{\pm} + p + \pi^{\pm} + \pi^{-}$ and $\pi^{\pm} + p \rightarrow \pi^{\pm} + p + \pi^{+} + \pi^{-} + \pi^{0}$ were collected for incoming pion momenta in excess of 2.5 BeV/c in order to have sufficiently good statistic to observe A_1, A_2, and B meson production. Results from this analysis are presented. NSA

N66-28645# Atomics International, Canoga Park, Calif.

DTF-II, A ONE-DIMENSIONAL, MULTIGROUP NEUTRON TRANSPORT PROGRAM

W. W. Engle, M. A. Boling, and B. W. Colston 25 Mar. 1966 103 p refs (Contract AT(11-1)-GEN-8) (NAA-SR-10951) CFSTI: HC $2.45/MF $0.75

The computer program DTF-II, which solves the multigroup one-dimensional neutron transport equation for either cylindrical, slab, or spherical geometries using the discrete s_n approximation, is described. The program is written in FORTRAN II for the IBM 7090/7094 computers. NSA

N66-28742# United Kingdom Atomic Energy Authority, Harwell (England).

CO-OPERATIVE MODES OF MOTION IN LIQUID METALS

P. A. Egelstaff *In* India. Dept. of Atomic Energy Lectures on Solid and Liquid State Phys. 1965 p 103–139 refs (See N66-28739 16-23) CFSTI: HC $6.00/MF $1.50

A physical description of elastic and inelastic neutron scattering is given and extended to describe the scattering process as a Doppler effect in a liquid assembly of atoms. Results of 5.3 Å neutron scattering by vitreous silica, crystalline vanadium, and liquid sodium, tin, and lead show a widened elastic peak that joined on to the inelastic region for all liquid metals studied. G.G.

N66-28743# Argonne National Lab., Ill.
THEORY OF NEUTRON SCATTERING FROM LIQUIDS
K. S. Singwi *In* India. Dept. of Atomic Energy Lectures on Solid and Liquid State Phys. 1965 p 140–177 refs (See N66-28739 16-23) CFSTI: HC $6.00/MF $1.50

Neutron scattering line shapes from liquids are evaluated by stochastic methods under consideration of coherent neutron scattering. It is shown that the two problems of neutron scattering and nuclear magnetic resonance are interrelated. Finally, a modified convolution approximation, taking into account the coherence effects, is used to develop the neutron scattering line of liquid argon. G.G.

N66-28757# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
A NOTE ON INVERTING THE R-MATRIX
T. Watanabe Jan. 1966 24 p ref
(Contract AT(10-1)-205)
(IDO-17142) CFSTI: HC $2.00/MF $0.50

The procedure of rank annihilation is applied to the inversion of the R-matrix. It is shown that the method inverts the R-matrix in a way similar to the method of Thomas but that it leads to a different form. The advantage of this particular method and some approximations are discussed. Author (NSA)

N66-28866# Polish Academy of Sciences, Warsaw.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE ROLE OF ATOMIC ELECTRONS IN NUCLEAR TRANSFORMATIONS, VOLUME I
[1963] 111 p refs Conf. held at Warsaw, 24–28 Sep. 1963
CFSTI: HC $4.00/MF $0.75

CONTENTS:

1. INTERNAL CONVERSION T. R. Gerholm and B. G. Pettersson (Stockhold Univ.) p 1–29 refs (See N66-28867 16-24)

2. ORBITAL ELECTRON CAPTURE BY THE NUCLEUS R. Bouchez and P. Depommier (Grenoble Univ.) p 30–59 refs (See N66-28868 16-24)

3. INTERNAL PAIR FORMATION AND ELECTROEXCITATION OF NUCLEI M. E. Rose (Va. Univ.) p 60–88 refs (See N66-28869 16-24)

N66-28867# Stockholm Univ. (Sweden). Inst. of Physics.
INTERNAL CONVERSION
T. R. Gerholm and B. G. Pettersson *In* Polish Acad. of Sci. Proc. of the Intern. Conf. on the Role of Atomic Electrons in Nucl. Transformations, Vol. I [1963] p 1–29 refs (See N66-28866 16-24) CFSTI: HC $4.00/MF $0.75

This article reviews the present knowledge of the internal conversion process used to determine the angular momentum and parity of a photon. Emphasis is on the M1 and E0 conversion processes. Here evidence exists for the presence of penetration matrix elements and the interpretation of the results agrees with theory. Anomalies have been found for certain strongly retarded E1 transitions. The interpretation of these anomalous E1 transitions in terms of nuclear penetration matrix elements is quite involved because it is necessary to consider two independent penetration matrix elements which may or may not be of comparable magnitudes. There is no clear cut evidence for anomalies in E2, M2, and higher multipoles. This agrees with theory. Penetration effects are to be expected only in the case of E0 and retarded M1 and E1 transitions. The internal conversion appears to be well understood in the present theory. In most cases the internal conversion coefficients, the K/L, and L subshell ratios may be used for spin and parity assignments of nuclear energy levels. However, care should be used for strongly retarded E1 and M1 transitions as large anomalies may show up. R.N.A.

N66-28868# Grenoble Univ. (France). Nuclear Physics Lab.
ORBITAL ELECTRON CAPTURE BY THE NUCLEUS
R. Bouchez and P. Depommier *In* Polish Acad. of Sci. Proc. of the Intern. Conf. on the Role of Atomic Electrons in Nucl. Transformations, Vol. I [1963] p 30–59 refs (See N66-28866 16-24) CFSTI: HC $4.00/MF $0.75

This paper presents the results of recent theoretical and experimental works on orbital electron capture. Included are works on L/K capture ratios, M/L capture ratios, capture to $\beta+$ emission ratios, and radiative orbital electron capture. R.N.A.

N66-28869# Virginia Univ., Charlottesville.
INTERNAL PAIR FORMATION AND ELECTROEXCITATION OF NUCLEI
M. E. Rose *In* Polish Acad. of Sci. Proc. of the Intern. Conf. on the Role of Atomic Electrons in Nucl. Transformations, Vol. I [1963] p 60–88 refs (See N66-28866 16-24) CFSTI: HC $4.00/MF $0.75

Internal pair formation and electroexcitation are two distinct physical processes which belong to different realms of nuclear physics as far as energy is concerned. In internal pair formation the largest energy is the energy transfer which is typically a few MeV, while in electroexcitation, incident electrons of a few hundred MeV are used and the energy transfer is usually the smallest energy involved. To determine their common features, consideration is given to two nuclear states A and B, energies E_A and E_B. One of these is the ground state of a stable nucleus. Starting in either state as the initial state, the problem involves learning something of their nuclear structure properties by studying transitions between them induced by electromagnetic interactions. The electroexcitation problem with oriented nuclei is presented in an accompanying paper which discusses methods for measuring polarization of electrons, positrons, and circularly polarized photons, with emphasis on the polarization-momentum correlation methods. R.N.A.

N66-28870# Polish Academy of Sciences, Warsaw.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE ROLE OF ATOMIC ELECTRONS IN NUCLEAR TRANSFORMATIONS, VOLUME III
[1963] 190 p refs Conf. held at Warsaw, 24–28 Sep. 1963
CFSTI: HC $5.00/MF $1.25

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5. ATOMIC M-LEVEL WIDTHS IN Sm^{151} AND THE MULTIPOLARITY OF THE 4.821 keV TRANSITION AS DETERMINED FROM INTERNAL CONVERSION ELECTRON STUDIES J. S. Geiger, R. L. Graham, and Janet S. Merritt (Atomic Energy of Can., Ltd., Chalk River) p 454–464 refs

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7. THE KLL-AUGER SPECTRUM OF MANGANESE Yau-Yin Lui and R. G. Albridge (Vanderbilt Univ.) p 480–486 refs

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N66-28871# Polish Academy of Sciences, Warsaw.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE ROLE OF ATOMIC ELECTRONS IN NUCLEAR TRANSFORMATIONS, VOLUME IV
[1963] 232 p refs Conf. held at Warsaw, 24–28 Sep. 1963
CFSTI: HC $6.00/MF $1.25

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N66-28881# European Organization for Nuclear Research, Geneva (Switzerland).
PROCEEDINGS OF THE 1965 EASTER SCHOOL FOR PHYSICISTS, USING THE CERN PROTON SYNCHROTRON AND SYNCHRO-CYCLOTRON, VOLUME III
K. Gottstein (Max-Planck Inst. für Physik) and W. O. Lock, ed. 14 Feb. 1966 125 p refs School held at Bad Kreuznach, W. Germany, 1–15 Apr. 1965
(CERN-65-24, Vol. III)

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3. NEUTRINO PHYSICS D. H. Perkins (Oxford Univ.) 29 p refs (See N66-28884 16-24)

4. CP INVARIANCE K. Winter 12 p refs (See N66-28885 16-24)

N66-28882# European Organization for Nuclear Research, Geneva (Switzerland). Theory Div.
SU_3 AND SU_6 SYMMETRY OF STRONG INTERACTIONS
L. Van Hove *In its* Proc. of the 1965 Easter School for Physicists, Vol. III 14 Feb. 1966 41 p refs (See N66-28881 16-24)

This discussion presents the SU_3 and SU_6 classifications schemes for the strongly interacting particles, the hadrons. These symmetry schemes, based on group theory, are a generalization of the successful isospin formalism introduced to account for the similarity of proton and neutron. The methods used in formulating and calculating the symmetry properties

are presented and are illustrated on the most significant predictions, mass formulae, magnetic moments of baryons, and meson–baryon interaction. The treatment of SU_6 is limited to the nonrelativistic case. R.N.A.

N66-28883# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).

QUANTUM ELECTRODYNAMICS IN THE NON-LINEAR SPINOR THEORY AND THE VALUE OF SOMMERFELD'S FINE STRUCTURE CONSTANT

H. P. Duerr, W. Heisenberg, K. Yamazaki, and H. Yamamoto *In* CERN Proc. of the 1965 Easter School of Physicists, Vol. III 14 Feb. 1966 21 p refs (See N66-28881 16-24)

The Goldstone theorem that the asymmetry of the vacuum requires, for consistency, the existence of bosons of rest mass zero is assumed. Thus, the question about the actual existence of mass zero photon solutions in the theory will be essentially clarified by taking the scale transformation (dilation group) into account. These considerations then allow a calculation of the electromagnetic coupling constant, i.e., the Sommerfeld fine structure constant. D.T.

N66-28884# Oxford Univ. (England).

NEUTRINO PHYSICS

D. H. Perkins *In* CERN Proc. of the 1965 Easter School for Physicists, Vol. III 14 Feb. 1966 29 p refs (See N66-28881 16-24)

Experiments with high energy neutrino beams from accelerators, reactors, and natural sources such as the sun and stars, and with neutrinos generated by the impact of cosmic rays upon the atmosphere are reported; emphasis is placed upon the synchrotron experiments. The two ways in which neutrinos can interact with matter are discussed: (1) a first order weak process, the classical four-fermion interaction; or (2) a second order process involving the induced electromagnetic properties of the neutrino. The weak interaction is assumed to be of the current–current type, and involves interaction of the lepton and/or baryon currents. It is useful to consider the lepton and baryon currents separately; for the latter involve properties of strong interactions, and from both the experimental and theoretical point of view are more complex. In the discussions the following main topics are considered: (1) basic properties of neutrinos; (2) neutrino interactions—problems relating to lepton currents; (3) neutrino interactions—problems relating to weak baryon currents; and (4) technical innovations necessary to investigate these problems with accelerators. D.T.

N66-28885# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.

CP INVARIANCE

K. Winter *In its* Proc. of the 1965 Easter School for Physicists, Vol. III 14 Feb. 1966 12 p refs (See N66-28881 16-24)

CP invariance is discussed for the K^0–$\bar{K}^0$ system, and for two-pion decay of the long lived K^0; and experiments of kaon decay in well collimated neutral beams at several hundred mean decay lengths of K_1 from the target are examined. Also, violation of CP invariance is considered for short and long lived neutral kaons. Equations are given for examples of CP violations. It is concluded that more experimental information is required on how and when CP invariance is violated. D.T.

N66-28887# United Kingdom Atomic Energy Authority, Culham (England).

AN APPARATUS FOR THE DETECTION AND ENERGY ANALYSIS OF FAST NEUTRAL ATOMS

D. W. Mason and J. M. S. Schofield 1966 21 p refs (CLM-R-49) HMSO: 3s

An apparatus was constructed to measure the energy and time dependence of the flux of neutral atoms emitted by charge exchange from plasma contained in a magnetic mirror machine. As the momentum change of the ions in this process is negligible, the energy measurements made outside the trap are simply related to the distribution function of the plasma ions within it. The atoms pass through a water vapor cell where approximately 6% are re-ionized. This fraction is electrostatically analyzed and counted using a scintillation technique. Measurements of the ionization efficiency and the scattering losses in the water vapor cell are described. Author

N66-28902*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

IONIZING PARTICLE RADIATIONS EFFECTS AND SIMULATION CONSIDERATION

J. E. Duberg and W. C. Hulten *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1964] 50 p refs (See N66-28899 16-11) CFSTI: HC $4.00/MF $1.00

Protons and electrons trapped in the earth's magnetosphere and high-energy protons associated with solar flare events are discussed as the radiation environments which present the greatest threat to both manned and unmanned spacecraft; and transient, permanent, surface, and chemical radiation effects are considered. An overview of recent studies on radiation effects deals with semiconductor, polymer, dielectric, and transparent window investigations. Arrangement and operation of the NASA space radiation effects laboratory are discussed, including the proton accelerator, electron accelerators, and beam transport system. M.W.R.

N66-28905# Atomic Weapons Research Establishment, Aldermaston (England).

THE CALCULATION OF GROUP AVERAGED NEUTRON CROSS SECTIONS. THE DEVELOPMENT OF GALAXY 3 FACILITIES IN S2 (FORTRAN) LANGUAGE FOR THE IBM 7030 (STRETCH) COMPUTER DURING 1965

P. Gately, K. Parker, P. Stanley, and D. V. J. Williams Feb. 1966 47 p refs

(AWRE-O-103/65) HMSO: 6s

Details are presented for a Fortran program called GALAXY 3 which converts group cross sections, mean free paths, collision probabilities, and other quantities which are directly usable as input in neutronic programs. Operations available in the output stage are described for GALAXY, which prepares multigroup methods for the solution of the neutron transport equation or the diffusion equation. Format of magnetic types is considered, as is mode of operation on the IBM 7030. Operating instructions are included for the IBM 7030 S2 Fortran programs designated ASCOT and DUNCE. M.W.R.

N66-28909# Colorado Univ., Boulder.

APPLICATIONS OF THE OPTICAL MODEL FOR 2 BeV/C K^- INTERACTIONS

F. Ayer, L. Marshall, and T. Oliphant (Los Alamos Sci. Lab.) *In* Comision Nacl. de Invest. Especiales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 7 p refs (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

Forms of optical model representations were applied to K^- elastic and charge exchange scattering at 2 BeV/c. An expression was developed for the diffraction scattering from a bright annulus of inner radius R=0.68 Fermi and annulus thickness R=0.09 Fermi, corresponding to an interaction radius R=0.77 Fermi. Computed diffraction scattering patterns and observed data for the elastic differential scattering cross section for 2 BeV/c K^- on protons are compared and graphed. The potentials in the Schroedinger equation which would represent the data were investigated. N.E.N.

N66-28928# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
p-SEPARATION OF VARIABLES IN THE SCHROEDINGER EQUATION [P-RAZDELENIE PEREMENNYKH V URAVNENII SHREDINGERA]
I. I. Tugov 1965 18 p refs In RUSSIAN
(JINR-P-2532)

The —p-separation of variables in the generalized Schrödinger equation $\Delta_2 u+(E-V)u=0$ in the n-dimensional Riemannian space is considered. It is shown that in the Einstein spaces the Schrödinger equation is completely separable, if p is separable. The separation of variables is treated in the invariant form. Author (NSA)

N66-28932# Brookhaven National Lab., Upton, N. Y.
MONTE CARLO METHODS IN RESONANCE ABSORPTION
Melvin M. Levine Oct. 1965 30 p refs Presented at the Natl. Meeting on Reactor Phys. in the Resonance and Thermal Regions, San Diego, Calif., 7–9 Feb. 1965
(Contract AT(30-2)-GEN-16)
(BNL-9644; CONF-660203-1) CFSTI: HC $2.00/MF $0.50

A review of the use of the Monte Carlo methods in the calculation of neutron resonance absorption is presented. The principles of the method are outlined, and the results of some Monte Carlo calculations are presented. A number of Monte Carlo codes are briefly discussed. NSA

N66-28941# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A POSSIBLE MECHANISM OF CP VIOLATION
B. A. Arbuzov and A. T. Filippov 1966 7 p refs Submitted for Publication
(JINR-E-2563)

The mechanism of CP-violation in interaction of particles with photons with the coupling constant G_e is considered. Possible experiments are discussed, which serve to check this mechanism. Author (NSA)

N66-28944# California Univ., Livermore. Lawrence Radiation Lab.
THE RADIAL WAVE EQUATIONS FOR A VECTOR MESON IN A SPHERICALLY SYMMETRIC POTENTIAL
Karl Fritz 27 Jan. 1966 11 p refs
(Contract W-7405-ENG-48)
(UCRL-14698-T) CFSTI: HC $1.00/MF $0.50

The radial wave equations for a spin-one particle are derived in a direct fashion by expanding the angular part in vector spherical harmonics, $e_r Y^m_j(\Omega)$, $L Y^m_j(\Omega)$, and $e_r \times L Y^m_j(\Omega)$. The orthogonality of these functions allows eliminating them to obtain radial wave equations which may be expressed in several different ways. Author (NSA)

N66-28945# Paris Univ., Orsay (France).
MEASUREMENT OF RECOIL PROTONS IN THE ELASTIC ELECTRON–PROTON SCATTERING [MESURE DE LA POLARISATION DU PROTON DE RECUL DANS LA DIFFUSION ELASTIQUE ELECTRON–PROTON]
Jean Buon (M.S. Thesis) Feb. 1965 114 p refs In FRENCH
(NP-15822)

An experiment was undertaken to verify the validity of the Born approximation in the first order in the elastic scattering of high energy electrons and protons. The experiment consisted of the measurement of the polarization of recoil protons in an elastic scattering of electrons having an energy of 950 Mev and scattering at an angle of 90° in the center-of-mass system. The electron beam from the Orsay linear accelerator was scattered in a liquid hydrogen target with a useful length of 4 cm. A spectrometer analyzes the recoil protons emitted at angle of 40.3° in the laboratory system, which corresponds to a pulse quadritransfer of 15.4 Fermi^{-2}. This spectrometer was designed with 2 quadrupoles and a uniform magnetic field. The resolution of motion quantity is approximately 1%. At the output of the spectrometer the transverse component of the polarization of the proton beam was measured in a polarimeter. This makes it possible to scatter the protons in a carbon block. The asymmetry of the second diffusion gives a polarization of the protons. The trajectories of each proton before and after this second scattering were determined by an ensemble of 4 spark chambers. These are released with 5 scintillation counters. The directions of the trajectories were measured with the precision of the order of 0.05% to reduce the systematic errors. The transverse component of the polarization was calculated with a method derived from the method of probability maximum. This method was applied to the distribution observed of the angle between the normal to the plane of the second scattering and the vertical direction. The determination of the trajectories and the calculation of the polarization were made on the Univac 1107 computer. This calculation of the polarization gives for the value of the transverse component perpendicular to the plane of the elastic electron-proton scattering a value of 0.040 ± 0.027. The value of the transverse component parallel to the plane of the elastic electron-proton scattering is 0.000 ± 0.028. The error indicated is a square mean of the statistical error 0.021 and of the estimated systematic error 0.017 and 0.018 for the two components. Author (NSA)

N66-28946# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
PARTIALLY INELASTIC TWO-BODY COLLISIONS
G. B. Rothbart 27 Oct. 1965 13 p refs
(Contract AT(04-3)-167)
(GA-6712) CFSTI: HC $1.00/MF $0.50

Theoretical expressions were derived in order to more fully understand experimental observations and to prepare optimum experimental conditions in which neutrons experience partially inelastic collisions. NSA

N66-28950# Academia R. P. R., Bucharest (Romania). Institutul de Fizica Atomica.
GAMMA–GAMMA ANGULAR CORRELATION MEASUREMENTS OF THERMAL-NEUTRON CAPTURE GAMMA RAYS IN Hg^{200}
V. Cojocaru, S. Dobrescu, R. Literat, M. Patrutescu, M. Petrascu et al May 1965 18 p refs
(IEA-RN-21)

The angular correlation measurements of gamma rays following the thermal neutron capture in Hg^{199} are presented. An angular correlation apparatus with two scintillation NaI(Tl) spectrometers and a sum-coincidence circuit were used. Five unknown energy levels were identified. The spins of the "capturing state" and of a few levels were also determined. Two of the five studied transitions were found to be multipolarity mixtures, that were measured. Author (NSA)

N66-28951# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

EFFECTIVENESS OF MAGNETIC SPECTROMETER FOR RECORDING $K^0 \rightarrow \pi^+ + \pi^-$ DECAY OF K^0 MESONS [EFFEKTIVNOST' MAGNITNOGO SPEKTROMETRA DLYA REGISTRATSII K^0-MEZONOV. RASPAD $K^0 \rightarrow \pi^+ + \pi^-$]

F. Zh. D'yuk 1965 36 p refs In RUSSIAN
(ITEF-386)

The efficiency of a magnetic spectrometer arrangement for the detection of K^0 mesons by the $\pi^+ + \pi^-$ decay mode was investigated. The dependence of the efficiency on the momentum and the decay coordinate of the K^0 meson is presented. Author (NSA)

N66-28953# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

APPLICATION OF UNITARY SYMMETRY TO MULTIPLE MESON PRODUCTION [PRIMENENIE UNITARNOI SIMMETRII K MNOZHESTVENNOMU ROZHDENIYU MEZONOV]

E. I. Daibog 1965 7 p refs In RUSSIAN
(JINR-P-2531)

It is shown that the Watson theorem concerning the ratio of the average number of charged and neutral mesons in multiple production is generalized to SU(3). The ratio of the number of π pions to that of π^0 and η^0, produced by high-energy nucleon collisions is calculated. A comparison with experiment was made. Author (NSA)

N66-28954# Atomic Energy Establishment, Winfrith (England).

CWF AND TABLE—TWO FORTRAN PROGRAMMES FOR THE CALCULATION OF COULOMB PENETRATION AND SHIFT FACTORS

D. S. Norton and M. F. James Dec. 1965 14 p refs
(AEEW-M-611) HMSO: 2s 6d

CWF and TABLE are Fortran programs, written for the IBM 7090 and English-Electric Leo Marconi KDF9 computers, that calculate the penetration and shift factors for a charged particle in a Coulomb field. The numerical methods used are those of Lutz and Karvelis. The two programs are very similar. Input to TABLE is in the form of the center-of-mass coordinates. CWF is intended for use in calculating cross sections for neutron-induced reactions which result in charged particle emission, and the input is in the form of the neutron energy in the laboratory frame of reference, together with other necessary reaction data. Author (NSA)

N66-28955# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.

A COMPUTER PROGRAMME FOR THE CALCULATION OF COMPOUND NUCLEAR CROSS-SECTIONS BY THE HAUSER-FESHBACH THEORY

D. Wilmore Jan. 1966 14 p refs
(AERE-R-5053) HMSO: 2s 6d

Hauser and Feshbach (Phys. Rev. 87: 366 (1952)) showed that if the processes of formation and decay of the compound nucleus are assumed to be independent then use of the reciprocity theorem allows the differential cross sections in all the reaction channels to be calculated. This calculation requires the transmission coefficient for all the inverse reactions, and these may be calculated from the optical potentials appropriate to these reactions. A computer program is described that carries out this calculation for any mass, charge, and spin of incident particle and target nucleus. The transmission coefficients for the incoming and all the outgoing channels may be fed in directly if they are known, or if not they are calculated from optical potentials. The program then calculates the differential cross section for the elastic scattering of the incident particle and the differential cross sections in all two-body reaction channels, including the compound elastic cross section when the incident particle is re-emitted into the incident channel. The reaction cross sections are all symmetric about 90°. Spin-orbit forces are not taken into account in the calculations. NSA

N66-28957# International Centre for Theoretical Physics, Trieste (Italy).

DISCRETE DEGENERATE REPRESENTATIONS OF NON-COMPACT UNITARY GROUPS

R. Raczka and J. Fischer Feb. 1966 43 p refs Submitted for Publication
(IC-66-16)

Two degenerate principal series of irreducible unitary representations of an arbitrary non-compact unitary group U(p,q) are derived. These series are determined by the eigenvalues of the first and second-order invariant operators, which are shown to possess a discrete spectrum. The explicit form of the corresponding harmonic functions is derived and the properties of the discrete representations are discussed in detail. Moreover, the properties of the corresponding degenerate representations of an arbitrary compact U(p) group are derived. Author (NSA)

N66-28958# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.

DEUTERON ELECTROMAGNETIC FORM FACTORS FOR $3\ F^{-2} < Q^2 < 6\ F^{-2}$

D. Benaksas, D. Drickey, and D. Frerejacque Mar. 1966 24 p refs
(LAL-1155)

Two groups of measurements were made on the elastic scattering of electrons by deuterium; in each case the recoil deuteron was observed instead of the scattered electron. In the first case the spectrometer was set at 45°, so that magnetic scattering was unimportant (about 10%), and the electric form factors of the deuteron were determined. In the second case deuterons were observed at 0°, permitting a direct measurement of the magnetic form factor of the deuteron. Form factors of the neutron were deduced from these measurements for the transfer values $q^2 = 3$, 4, and 5 (f^{-2}). Author (NSA)

N66-28960# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ELECTROMAGNETIC INTERACTION OF THE χ-MESON IN HIGHER SYMMETRIES [ELEKTROMAGNITNYE VZAIMODEISTVIYA χ-MEZONA V VYSSHIKH SIMMETRIYAKH]

O. G. Bokov, Nguen Van Hieu, and B. Sredniava 1965 8 p refs In RUSSIAN
(JINR-P-2520)

Radiative decays of the ninth pseudoscalar meson $\chi(960)$ are treated. Relations were obtained between the coupling constants of one-photon decays of the χ-meson and the nonet of the vector mesons as well as similar relations for two-photon decays of the nonet of the pseudoscalar mesons in the scheme of intrinsically broken U(12) symmetry. Branching ratios for corresponding processes were calculated. Author (NSA)

N66-28961# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
EFFECT OF ATOMIC HYPERFINE INTERACTION ON NUCLEAR γ-TRANSITIONS [VLIYANIE SVERKHTONKOGO VZAIMODEISTVIYA V ATOMAKH NA YADERNYE γ-PEREKHODY]
V. A. Onishchuk 1965 6 p refs In RUSSIAN
(JINR-P-2512)

A concrete example is taken to illustrate the effect of hyperfine interaction on nuclear γ transitions. It is shown that in atomic states with a fixed projection of the total angular momentum the expressions for the angular distributions of both the polarized and unpolarized γ rays may involve noticeable interference terms. Author (NSA)

N66-28963# Goodyear Atomic Corp., Piketon, Ohio.
ENVIRONMENTAL RADIATION LEVELS AND CONCENTRATIONS. SECOND HALF AND ANNUAL SUMMARIES, 1965
B. Kalmon and S. H. Hulett 18 Feb. 1966 15 p ref
(Contract AT(33-2)-1)
(GAT-506) CFSTI: HC $1.00/MF $0.50

Average environmental radiation and concentration levels in air and water in the vicinity of the Portsmouth Area Gaseous Diffusion Plant for the second half of the calendar year 1965, and for the complete calendar year 1965 are summarized. The results for the first half of 1965 are included in tabular form. For the second half of 1965, both the airborne alpha and beta-gamma activity dropped significantly compared to the first half of 1965. The alpha airborne average for the second half of the calendar year dropped from 16.1 to 9.7% of the maximum permissible concentration. The beta–gamma concentration was less than 0.01% compared to 0.05% for the first half. During the last half of 1965, the average alpha concentration in the water effluents increased while the beta–gamma activity decreased. The highest individual results for alpha and beta–gamma were 12 and 18% of the maximum permissible concentration. Penetrating background exposure rates continued to decline from the 1964 annual average of 48 to 27.7% of the maximum permissible exposure (MPE) in 1965. The second half of 1965 was also lower than the first half of 1965. It was concluded that plant operations have not added appreciably to the general background penetrating radiation. Over-all average concentrations in air and water along with the background exposure rates for both halves of 1965, the over-all 1965 averages, and the over-all 1964 averages are tabulated. Author (NSA)

N66-28964# Connecticut Univ., Storrs. Dept. of Physics.
INVESTIGATIONS OF RADIATION EFFECTS IN METAL OXIDES AND AZIDES BY ELECTRON SPIN RESONANCE Progress Report, Feb. 1, 1965–Jan. 31, 1966
Ralph H. Bartram and Otis R. Gilliam 31 Jan. 1966 86 p refs Presented at the APS Meeting, Durham, N. C., 28–31 Mar. 1966
(Contract AT(30-1)-2047)
(NYO-2047-36) CFSTI: HC $3.00/MF $0.75

Radioinduced defects in single crystals of metal oxides, alkali azides and crystals of related structure are investigated experimentally and theoretically. The crystals are irradiated by use of a Van de Graaff electron accelerator, the Brookhaven Research Reactor, Co^{60} gamma sources, or ultraviolet light and changes in the defect structure are observed by electron spin resonance (ESR). Investigations were continued on the trapped F_2^- ion in electron-irradiated KHF_2. Several electronic temperature controllers and programmers were constructed which permitted the growth of improved large crystals of KHF_2 for associated optical and ESR measurements. Some ESR measurements on reactor-irradiated Al_2O_3 were made at 35-Gc/sec to enhance the resolution of poorly resolved components. A study of radiation effects in electron-irradiated Al_2O_3 is continuing with different sample specimens and with different irradiation conditions than previously employed. An investigation of defects in $CaMoO_4$ caused by gamma-ray irradiation is in progress. Theoretical investigations of radiation effects in ionic crystals are conducted with the objective of accounting quantitatively for the optical and ESR absorption spectra of radiation-induced defects, and of understanding the radiation-damage mechanism. A calculation of wave functions for F'-centers in alkali halides was completed. A theory was developed to explain the anomalous g shift of F-centers in alkaline-earth oxides, sulfides and selenides, in terms of configuration mixing, and a manuscript is being prepared for publication. A molecular orbital calculation of $(AlO)^{3-}$ in Al_2O_3 verified the triplet ground state and yielded a reasonable optical absorption band. It became apparent that electron correlation plays a dominant role in the zero-field splitting. NSA

N66-28965# Japan Atomic Energy Research Inst., Tokyo.
NELKER: A CODE FOR SCATTERING KERNAL CALCULATION FOR BOUND HYDROGEN
Syoichiro Shimada Dec. 1964 9 p refs In JAPANESE; ENGLISH summary
(JAERI-1085)

A description is presented of the NELKER code in FORTRAN-II for IBM-7090. NELKER is a program for calculating the thermal neutron scattering-kernel matrices for bound hydrogen by Nelkin's formulation. In addition to the scattering kernel the program computes the following quantities: differential scattering cross sections, total scattering cross section and transport cross section, and scattering law. Limitations in the code are as follows: the number of energy mesh points ≤ 60, the number of scattering angles ≤ 20, and the number of Legendre components of scattering kernel ≤ 3. The physical formulation of the kernel is also given. Author (NSA)

N66-28966# Oak Ridge National Lab., Tenn.
REACT AND CONVRG, FORTRAN SUBROUTINES FOR DETERMINING SOURCE CONVERGENCE FOR THE 05R MONTE CARLO NEUTRON TRANSPORT CODE
G. W. Morrison, J. T. Mihalczo, and D. C. Irving 10 Jan. 1966 22 p ref
(Contract W-7405-ENG-26)
(ORNL-TM-1325) CFSTI: HC $1.00/MF $0.50

REACT is a FORTRAN subroutine for analyzing the neutron history tapes from the 05R Monte Carlo neutron transport code and for calculating the probability that a neutron born in one

region will produce a neutron in another region. CONVRG is a FORTRAN subroutine for forming a matrix of the probabilities calculated by REACT and then iterating on the initial source distribution with this matrix until convergence is obtained. The number of iterations required for convergence is the average number of batches (generations) required for spatial convergence. The largest eigenvalue of this matrix, the neutron multiplication factor, is also calculated by CONVRG.

Author (NSA)

N66-28967# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

APPROXIMATE FORMULAE FOR A VARIETY OF SOLUTIONS OF THE THOMAS–FERMI EQUATION

J. C. Mason Jan. 1966 19 p refs

(Contract AT(40-1)-3443)

(BN-430; TID-22530) CFSTI: HC $1.00/MF $0.50

In the Thomas–Fermi method of determining the potential produced by an atom at zero temperature, electrons are considered as a spherically symmetric cloud charge, with positive charges of nuclei smoothed out over the surface of a sphere of given radius. Two rational approximations are produced which, together with an approximation given previously, will generate accurate solutions of the dimensionless Thomas–Fermi equation both inside and outside the sphere for any radius in a certain range. A new method is used for obtaining rational approximations directly from an ordinary differential equation.

Author (NSA)

N66-28980# Los Alamos Scientific Lab., N. Mex.

GAMLEG—A FORTRAN CODE TO PRODUCE MULTIGROUP CROSS SECTIONS FOR PHOTON TRANSPORT CALCULATIONS

K. D. Lathrop 23 Apr. 1965 32 p refs

(Contract W-7405-ENG-36)

(LA-3267) CFSTI: HC $2.00/MF $0.50

GAMLEG is a cross section code which prepares group averages of the Legendre moments of the Klein–Nishina differential scattering cross section. For the isotropic component the group scattering cross section is prepared and compared to the sum of the partial cross sections to insure consistency. The code also accepts as input, absorption, coherent scattering, source, and flux data (for up to 1000 pieces of information at up to 1000 energy points for each type of input), and provides group averages of this data. At the option of the user, cross sections can be flux weighted, source weighted, or unweighted. Up to 100 energy groups can be formed from group energy bounds supplied by the user. Group averages are performed by trapezoidal integration at up to 100 intervals in each group. As written, up to six Legendre component scattering matrices may be prepared for an arbitrary number of elements. Additional moments may be prepared with minor code modification. Cross section output is in a form suitable for input to the Los Alamos DTF and DDF transport codes.

Author (NSA)

N66-28988# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

SCATTERING OF A COMPLEX PARTICLE ON THE FORCE CENTER [RASSEYANIE SLOZHNOI CHASTITSY NA SILOVOM TSENTRE]

A. A. Khelashvili 1966 10 p refs In RUSSIAN

(JINR-P-2565)

It is proved that it is possible to reduce the problem of a complex particle scattering on the force center to the many-channel problem of particle scattering on a certain "generalized potential" which is dependent on the internal motion of the bound system. A "potential" for the Yukawa interaction is constructed.

Author (NSA)

N66-28992# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

TWO-MESON ANNIHILATION OF BARYONS IN BROKEN SL(6,C) SYMMETRY [DVUKHMEZONNAYA ANNIGILYATSIYA BARIONOV V NARUSHENNOI SIMMETRII SL(6,C)]

P. Winternitz and A. A. Makarov 1966 8 p refs In RUSSIAN

Submitted for Publication

(JINR-P-2547)

The two-meson annihilation of a pp pair at rest is considered assuming the SL(6,C) symmetry. Relations between the amplitudes and cross sections of various processes are obtained in good agreement with the experimental data.

Author (NSA)

N66-28995# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

HIGHLY POLARIZED COHERENT BREMSSTRAHLUNG FROM A DIAMOND TARGET IN THE GeV REGION

G. Bologna, G. Lutz, H. D. Schulz, U. Timm and W. Zimmerman Nov. 1965 24 p refs

(DESY-65/15)

The bremsstrahlung spectra obtained from a diamond radiator at an electron energy of 4.6 Bev is discussed. The work has essentially two results: (1) The exponentially screened potential of the C atom which was used earlier in calculating the bremsstrahlung cross section is not consistent with the experimental spectra. Instead a Hartree type screening potential was used which fits the data very well. (2) The linear polarization obtained from the first peak in a spectrum is much increased, if the orientation of the primary electron momentum is chosen to lie not in the fundamental reference planes of the crystal but at a small angle to one of them. Author (NSA)

N66-28997# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).

SPECTRUM OF GAMMA-RAYS EMITTED DURING THE CAPTURE OF THERMAL NEUTRONS IN TELLURIUM [SPEKTR GAMMA-LUCHEI VOZNIKAYUSHCHIKA PRI ZAKHVATE TEPLOVYKH NEITRONOV V TELLURE]

L. V. Groshev, A. M. Demidov, and N. Shadiev 1965 16 p refs In RUSSIAN

(IAE-966)

The spectrum of γ rays emitted in the capture of thermal neutrons by Te was measured using a magnetic Compton spectrometer with 0.3% resolution. Identification of the γ lines with the Te isotopes was carried out. Detailed data were obtained for the isotope ^{124}Te. The neutron binding energy of this isotope was determined to be 9410 $\pm$5 keV. The decay of the initial state of the isotopes ^{124}Te, ^{114}Cd, and ^{118}Sn is examined.

Author (NSA)

N66-29003# International Centre for Theoretical Physics, Trieste (Italy).

THE STRONG VERTEX ACCORDING TO SL(6,C)

C. Fronsdal and R. White 4 Mar. 1966 11 p refs

(IC-66/20)

A non-compact algebra S that contains SL(6,c) as a subalgebra is considered. Its relation to the Poincaré algebra is P = S (semidirect sum). The respresentations that give theories of the Gürsey-Radicati SU(6) type are determined by the value of a simple degenerate mass, and an irreducible representation of S. These representations are discussed. NSA

N66-29035# International Centre for Theoretical Physics, Trieste (Italy).
ATTEMPTS AT UNDERSTANDING THE MASS SPECTRA OF ELEMENTARY PARTICLES
G. Bisiacchi and C. Fronsdal Mar. 1966 20 p refs
(IC/66/19)

Answers to the following 5 questions are presented and discussed: (1) is there a sense in which the mass operators for baryons and for mesons can be said to be equal, (2) does the mass operator transform like a component of an irreducible SL (6,c) tensor, (3) how does the mass operator transform under Lorentz transformations, (4) in the framework of SL (6,c), can mixing between different SU(6) representations be avoided, and (5) what are the qualitative features of the mass spectrum for higher SU(6) multiplets. NSA

N66-29037# California Univ., Livermore. Lawrence Radiation Lab.
THE CHARGE EXCHANGE REACTION
J. D. Anderson 11 Mar. 1966 35 p refs
(Contract W-7408-ENG-48)
(UCRL-14760-T; CONF-660306-1) CFSTI: HC $2.00/MF $0.50

An investigation of the (p,n) cross sections for the titanium isotopes A=46–50 was made in order to check the charge independent formulation of the optical model which was independent of any optical parameters, i.e., the cross section is proportional to the neutron excess. An investigation is presented of the ^{25}Mg and ^{26}Mg (p,n) reactions which Satchler had suggested would shed some light on the mechanism involved in the (p,n) transitions to excited analog states. Also, the (p,n) cross sections on ^{17}O and ^{18}O were investigated for the purpose of deducing features of the two body force from a microscopic description of the (p,n) reaction. The results and conclusions from these experiments are presented. NSA

N66-29041# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CHARGED MESON PRODUCTION IN NEUTRON–PROTON COLLISIONS AT 600 MeV NEUTRON ENERGY
V. P. Dzhelepov, V. S. Kiselev, K. O. Oganesyan, and V. B. Flyagin 22 Dec. 1965 24 p refs In RUSSIAN
(JINR-P-2511)

The production of mesons ($\pi^{\pm}$) in n–p interactions at about 600 MeV was investigated using a multichannel magnetic spectrometer. An analysis of the results shows that in spite of the dominating role of resonance pion production, it is necessary to take into account the non-resonance transfer contributions in phenomenological considerations. NSA

N66-29044# California Univ., Livermore. Lawrence Radiation Lab.
THE NON-DYNAMICAL STRUCTURE OF PHOTOPRODUCTION PROCESSES
Paul L. Csonka, Michael J. Moravcsik, and Michael D. Scadron Jan. 1966 68 p refs
(Contract W-7405-ENG-48)
(UCRL-14614-T) CFSTI: HC $3.00/MF $0.75

Those general properties of photoproduction processes which are independent of the interactions among particles are summarized. The two types of interactions considered in detail are $\gamma + 1/2 \rightarrow s + 1/2$ and $\gamma + 1/2 \rightarrow s + 3/2$, where 1/2 and 3/2 denote particles with spins 1/2 and 3/2, respectively, and s denotes a particle with an arbitrary integer spin s. The first of these interactions is synthesized from the interactions $\gamma + 0 \rightarrow 0 + 0$, $0 + 1/2 \rightarrow 0 + 1/2$, and $0 + 0 \rightarrow s + 0$. First, the observable structure of these constituent interactions is derived, and then the composite structure is obtained. Detailed results for the observables are given for s = 0, 1, and 2, and experiments designed to determine spin and parity are listed. The interaction $\gamma + 1/2 \rightarrow s + 3/2$ is similarly composed of $\gamma + 0 \rightarrow 0 + 0$, $0 + 1/2 \rightarrow 0 + 3/2$, and $0 + 0 \rightarrow s + 0$. Some results for this interaction are also tabulated. Finally, as a specific application of the above results, a method is proposed for determining the contribution of certain corrections to the static theory of pion photoproduction from nucleons. Author (NSA)

N66-29045# International Centre for Theoretical Physics, Trieste (Italy).
P-WAVE NON-LEPTONIC DECAYS OF HYPERONS IN SU(6) AND REPRESENTATION MIXING
T. S. Santhanam 28 Mar. 1966 5 p refs Submitted for Publication
(IC-66/26)

Assuming that the final baryon in the p–c nonleptonic hyperon decays belongs to the completely antisymmetric representation, it is shown that $B(\Sigma^{=})=0$. Author (NSA)

N66-29046# International Centre for Theoretical Physics, Trieste (Italy).
PARTIAL CONSERVATION OF TENSOR CURRENT AND ELECTROMAGNETIC DECAYS
W. Krolikowski 25 Mar. 1966 8 p refs
(IC-66/25)

Meson electromagnetic decays are discussed on the grounds of a hypothesis called "the partial conservation of a tensor current." Author (NSA)

N66-29049# Joint Inst. for Nuclear Research, Dubna (USSR).
ON THE STRUCTURE OF SPONTANEOUSLY FISSIONING ISOMERS
L. A. Malov, S. M. Polikanov, and V. G. Soloviev 1965 15 p refs
(JINR-E-2515)

The possibility of the existence of isomeric states with deformations larger than those of nuclei in the ground state was studied. Under the assumption that spontaneously fissioning isomers are two-quasi-particle states of odd–odd nuclei with the equilibrium deformation δ_i=0.31 to 0.33 and an excitation energy with respect to the ground state of the nucleus at δ_0 of the order of 1.0 to 1.5 MeV, the probabilities of the spontaneous fission of such isomers in odd–odd nuclei were estimated. The possibility of the existence of spontaneously fissioning isomers in odd-A and even–even nuclei was also considered. NSA

N66-29063# Oak Ridge National Lab., Tenn.
ELECTRON CAPTURE CROSS SECTIONS AND NEGATIVE ION LIFETIMES

R. N. Compton, G. S. Hurst, L. G. Christophorou, and P. W. Reinhardt (M.S. Thesis—Tenn. Univ.) Mar. 1966 191 p refs (Contract W-7405-ENG-26)
(ORNL-TM-1409) CFSTI: HC $5.00/MF $1.00

A method was developed which combined the electron swarm and electron beam techniques to obtain electron capture cross sections as a function of the electron energy. As examples of the method, electron capture cross sections were explicitly determined for chlorotoluene (peaking at ~1 eV) and oxygen (peaking at ~7 eV). The procedure proved to be a powerful method in determining both the magnitude of the attachment cross section and the electron energy scale. In the case of oxygen, good agreement with the data of total ionization experiments was found with respect to the magnitude and energy dependence of the cross section. The dissociative electron attachment cross section for H^- from water was determined. In addition, ion molecule reactions leading to OH^- were definitely attributed to the following processes: $H^-+H_2O \rightarrow OH^-+H_2$ and $O^-+H_2O \rightarrow OH^-+OH$. The swarm-beam method was also used to study electron attachment in a series of halogenated hydrocarbons. Certain correlations were observed to exist between the magnitude and position of the cross section and the type of halogen substituent. Dissociative attachment in iodobenzene leading to iodine negative ions was observed to peak at electron energies below kT. Non-dissociative electron attachment to complex molecules was investigated both experimentally and theoretically. Unimolecular electron attachment was observed in the following molecules: SF_6, $C_6H_5NO_2$, o-$C_6H_4CH_3NO_2$, m-$C_6H_4CH_3NO_2$, and $(CH_3CO)_2$. It was demonstrated that the parent negative ions thus formed are metastable, and the half lives against autodetachment for SF_6^{-*}, $C_6H_5NO_2^{-*}$, and $(CH_3CO)_2^{-*}$ were determined to be 24, 40 and 12 microseconds, respectively. A theoretical study of long-lived negative ions was presented which treated the molecule as a system of harmonic oscillators. Specifically, the negative ion lifetime was related to the electron capture cross section by the principle of detail balance. The attachment cross section was assumed to be the maximum possible. The theory successfully accounted for the measured lifetime of the SF_6^{-*} ions. The possibility of combining electron capture cross sections and negative ion lifetime measurements to determine electron affinities was pointed out. As an example, the electron affinity of $(CH_3CO)_2$ was calculated to be ~1.1 eV. Author (NSA)

N66-29055# Paris Univ., Orsay (France).
DISPERSION CORRECTIONS TO ELECTRON SCATTERING IN ^{12}C AND ^{16}O
A. Bottino, G. Ciocchetti, and A. Molinari, (Turin Univ.) Jan. 1966 32 p refs Prepared jointly with Turin Univ.
(LAL-1153)

Calculations of the dispersive corrections to elastic (^{16}O and ^{12}C) and inelastic (^{12}C) electron scattering are done in second Born approximation taking as intermediate nuclear levels the most excitable by means of electron scattering. Dispersive effects of the order of 1/Z are found at the diffraction minima of the form factors and for high energy and large angles. Wave distortions in the inelastic scattering are also briefly discussed. Author (NSA)

N66-29058# Joint Inst. for Nuclear Research, Dubna (USSR) Lab. of Theoretical Physics.
DISPERSION SUM RULES AND SU(6) SYMMETRY, PART II
I. G. Aznauryan and L. D. Soloviev 1966 16 p refs
(JINR-E-2544)

On the basis of the sum rules following from the usual one-dimensional dispersion relations, the following were obtained: (1) relations between the pion–baryon coupling constants and the decay widths of the nearest resonances, (2) relations between the magnetic moments of baryons and those of the radiation decays of the resonances, and (3) the relations for the form factors, which together with $SU(6)_w$ symmetry lead to the equality $G_M^{(p)}(R^2)/G_E^{(p)}(R^2)=3$. The results are compared with experiment and with predictions of SU(6) symmetry. Author (NSA)

N66-29089# Brookhaven National Lab., Upton, N. Y.
BOSON RESONANCES
N. P. Samios Jan. 1966 14 p Presented at 3d Coral Gables Conf. on Symmetry Principles at High Energy, Coral Gables, Fla., 19–21 Jan. 1966
(Contract AT(30-2)-GEN-16)
(BNL-9934; CONF-660105-2) CFSTI: HC $1.00/MF $0.50

An experimentalist's view on the theory of boson resonances is presented. The discussion gives the author's view as what is believed to exist, what is not verified, and what the possible difficulties are. NSA

N66-29090# Yale Univ., New Haven, Conn.
NUCLEON–NUCLEON SCATTERING
G. Breit 9 Feb. 1966 24 p refs Presented at Conf. on Intermediate Energy Phys., Williamsburg, Va., 9–11 Feb. 1966
(Contract AT(30-1)-1807)
(Yale-1807-33; CONF-660209-1) CFSTI: HC $2.00/MF $0.50

The discussion is confined to energies at which meson production has a negligible effect. Scattering can then be described by means of real phase shifts and coupling parameters. Various aspects of nucleon–nucleon interactions are discussed, and a review of corresponding data is presented. NSA

N66-29092# North Dakota Univ., Grand Forks. Dept. of Physics.
A SMALL-ANGLE X-RAY SCATTERING STUDY OF RADIATION DAMAGE TO SILICA GELS
Bennett C. Larson and Harold D. Bale [1965] 15 p refs Presented at Conf. on Small-Angle X-ray scattering, Syracuse, N. Y., 24 Jun. 1965 Submitted for Publication
(Contract AT(11-1)-1255)
(CONF-650629-3) CFSTI: HC $1.00/MF $0.50

Four different silicon dioxide materials were pile irradiated to a fast neutron dose in excess of 10^{19} n/cm^2. In two of the samples irradiation produced a slight increase in the scattered intensity at the smallest angles and a decrease of intensity in the inverse fourth power region. The latter is attributed to a decrease in surface area for the sample. The coarsest gel studied showed very little change in the scattering curve after 1 week of irradiation, 2×10^{19} n$_f$/cm^2. The sample with the finest structure was very susceptible to irradiation effects. The mechanism of damage is discussed. Two different methods were used to calculate the surface areas from the X-ray data. NSA

N66-29094# Atomic Energy Establishment, Winfrith (England). Reactor Group.
SLP—A SINGLE LEVEL BREIT-WIGNER CROSS-SECTION GENERATING PROGRAMME
G. Doherty Jun. 1965 10 p refs
(AEEW-M-606) HMSO: 2s 6d

Unbroadened cross-sections are calculated from a single level Breit-Wigner approximation which allows for resonance-potential interference but not resonance-resonance

interference. Doppler broadening and instrumental resolution broadening for thin samples are optionally performed by successive numerical convolutions. An energy point selection and discard system enables the cross section over a specified energy range to be represented to a required degree of accuracy using the minimum number of energy points. An energy grid prepared by the user can be incorporated in the calculation but the program will usually be more efficient if only the end points of the energy range of interest are specified by the user and the intermediate energy points left to the program to organize. The capacity of the program varies with the energy range and type of resonance (narrow or broad). About fifty resonances may be sufficient to generate an energy grid of 4000 energy points, which is the maximum allowable energy vector. The program is written in KDF9 EGTRAN (a FORTRAN dialect); output is printed and may be copied on cards, and intermediate results are stored on magnetic disc. Author (NSA)

N66-29098# Reactor Centrum Nederland, Petten.
REVIEW OF ACTIVATION METHODS FOR THE DETERMINATION OF INTERMEDIATE NEUTRON SPECTRA
W. L. Zijp 12 Oct. 1965 107 p refs
(RCN-40)

A review is given of the possibilities for determining flux densities, fluences, and spectra of intermediate neutrons from the counting results obtained with resonance detectors. After introductory sections in which several basic concepts and formalisms are mentioned, some resonance reactions of interest are considered. Following chapters are devoted to the concepts of cadmium ratio and cadmium cut-off, to the resonance integral concept and to the self-shielding effect. Procedures for determining intermediate flux densities are discussed for the case of a 1/E spectrum and for an unknown spectrum. Tables with nuclear data and an extensive bibliography are included. Author (NSA)

N66-29103# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
RECOILLESS GAMMA-RAY EMISSION FOLLOWING COULOMB EXCITATION
G. Czjzek [1965] 30 p refs Presented at the Southeastern Section of the Am. Phys. Soc., Charlottesville, Va., 1-3 Nov. 1965
(Contract W-7405-ENG-26)
(ORNL-P-1966; CONF-651135-1) CFSTI: HC $2.00/MF $0.50

The Mossbauer effect is briefly reviewed. The method of Coulomb excitation is discussed. This method was used to measure the recoilless γ ray emission from Ni^{61} and Ge^{73} when bombarded by 25-Mev O^{16} ions. NSA

N66-29105# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION ABSORPTION PHENOMENA IN GASES
Bandel Bezzerides (Ph.D. Thesis) 1 Jan. 1966 122 p refs
(Contract W-7405-ENG-48)
(UCRL-16635) CFSTI: HC $4.00/MF $0.75

Green's function techniques are used to develop a general theory of line broadening in gases. As an example, the impact theory of Baranger et al., is derived, including effects due to recoil of the emitting atom. The fundamental processes responsible for the detailed structure of the absorption line are exhibited with the aid of a generalized optical theorem for scattering from thermal systems. To the extent to which intuitive notions of scattering theory are applicable, it is possible to define partial absorption rates corresponding to overall coherent scattering processes. In particular, the fluorescence and quenching of an atom excited by resonance radiation are defined precisely, and a simple formula is given for the branching ratio between these two de-excitation channels. Author (NSA)

N66-29106# Polish Academy of Sciences, Cracow.
OPTICAL MODEL AMBIGUITIES FOR THE α-^{59}Co INTERACTION
A. Budzanowski, A. Dudek, K. Grotowski, J. Kuzminski, H. Niewodniczanski et al Jan. 1966 11 p refs
(INP-440/PL)

The angular distribution for the elastic scattering of 24.7-Mev alpha particles by ^{59}Co was measured, together with the total cross section for alpha reactions with ^{59}Co. The data were analyzed using a simple two-body optical potential for the interaction between the incident alpha particle and the nucleus. NSA

N66-29109# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A POSSIBLE DIRECT TEST OF CP VIOLATION IN THE K_2^0 INTERACTIONS
B. A. Arbuzov and A. T. Filippov 3 Mar. 1966 7 p refs Submitted for Publication
(JINR-E-2614)

Experiments are proposed to test the CP violation in a direct way. The processes $K_2^0 \rightarrow \pi^0 e^+ e^-$ and $K_2^0 \rightarrow z \rightarrow \pi^0(\gamma\gamma^0)$ + z, which are forbidden in the one-photon exchange approximation by CP invariance, are considered. The estimates are given for the probabilities of these processes on the basis of the CP violating mechanism which was proposed earlier. Author (NSA)

N66-29120# California Univ., Livermore. Lawrence Radiation Lab.
ISOBARIC SPIN CONSERVATION AND β-DECAY
Stewart D. Bloom 11 Mar. 1966 13 p refs Presented at Am. Phys. Soc. Conf. on Isobaric Spin, Tallahassee
(Contract W-7408-ENG-48)
(UCRL-14750-T; CONF-660306-2) CFSTI: HC $1.00/MF $0.50

Beta decay is discussed from the standpoint of V-A theory. Values for $|\langle H_c \rangle|$, the charge-dependent matrix element, are discussed. Experimental data are given in conjunction with the theoretical aspects discussed. NSA

N66-29121# Mound Lab., Miamisburg, Ohio.
WEAK ALPHA AND ELECTRON-CAPTURE DECAY IN Po-208 AND Po-209
G. R. Hagee (Ph.D. Thesis—Cincinnati Univ.), R. C. Lange, and J. T. Mc Carthy (Cincinnati Univ.) Jan. 1966 48 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1251J) CFSTI: HC $2.00/MF $0.50

The weak alpha and electron-capture decay modes of ^{208}Po and ^{209}Po were investigated. Previously unobserved alpha groups were found at 4.22 MeV with 2.44×10^{-4}% abundance in ^{208}Po decay and at 4.11 and 4.31 MeV with 5.66×10^{-4}% and 1.46×10^{-4}% abundances, respectively, in ^{209}Po decay. The 4.617 MeV alpha group in ^{209}Po was measured explicitly and found to have 0.48% branching. Electron-capture branchings in ^{209}Po and ^{209}Po were measured as 1.81×10^{-3}% and 0.263%, respectively. Predominant electron-capture feeding in ^{208}Po populates a 921 keV

level in ^{209}Bi. The log ft value of this transition was determined to be 13.7 in agreement with its assignment as a second forbidden transition ($\Delta I=2$, $\Delta\pi=NO$). Gamma-rays following electron-capture decay in ^{209}Po were found at energies of 65, 291, 534, 565, 599 and 856 keV. Measurements of internal conversion coefficients or K to L+M shell conversion electron ratios on the 291, 534, 565 and 599 keV transition in ^{209}Po or 263 and 900 keV transitions in ^{209}Po show them to be pure M1 or mixed M1+E2 transitions.
Author (NSA)

N66-29141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION RULES FOR NONADIABATIC TRANSITIONS
N. N. Kristofel' 23 Mar. 1966 12 p refs Transl. into ENGLISH from Tr. Inst. Fiz. i Astron., Akad. Nauk Est. SSR (Tartu), no. 21, 1962 p 12–19
(FTD-TT-65-1490/1+4; TT-66-61101; AD-631579) CFSTI: HC $1.60/MF $0.50

The problem of the symmetry of nuclear oscillations which permit nonadiabatic transition between definite electronic states is discussed.
TAB

N66-29148# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TABLES OF COEFFICIENTS FOR ANGULAR CORRELATION OF RADIATIVE TRANSITIONS FROM ALIGNED NUCLEI
D. D. Watson and Gale I. Harris Feb. 1966 175 p refs
(ARL-66-0030; AD-631954) CFSTI: HC $5.00/MF $1.00

The report contains a list of basic formulas and tabulations of numerical coefficients which are useful for the analysis of data on intensity-direction correlations of successive radiative transitions from aligned nuclei. The formulas are extracted from an earlier published development of the angular correlation formalism. This development is based upon a factored version of the equations which is used to extend the application from the usual two-step cascade to general multiple-step cascades. The resulting flexibility and greater efficiency of the formalism is utilized in this report to provide an extensive tabulation of coefficients for a variety of specific applications. Coefficients are provided for analysis in terms of either the population parameters or the statistical tensors of the aligned state. The coefficients can be used for the analysis of angular distributions, triple correlations, and triple correlations involving one or more intermediate unobserved radiations. In contrast with previous tabulations of coefficients for angular-correlation analysis, the range of the present tables has been extended to include multipolarities through octupole. The overall length of the tables, however, remains about the same as previous tables because of the greater efficiency of the factored formalism. The range of spins covered by the tables are J<or=1-1/2 for the initial aligned state and J<or 2-1/2 for the final state of a cascade. Author (TAB)

N66-29153# Institute of Modern Languages, Inc., Washington, D. C.
IONIZATION OF THE HYDROGEN ATOM UNDER THE ACTION OF INTENSE ELECTROMAGNETIC RADIATION
A. D. Gazazian and B. O. Chaltukian Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Apr. 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Arm. SSR (Yerevan), v. 41, 1965 p 27–32
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1832-66; TT-66-61088; AD-631434) CFSTI: HC $1.00/MF $0.50

Equations are derived for determining the ionization of the hydrogen atom in a circularly polarized field of intensive electromagnetic radiation with the absorption of a few light quanta. Formulas are given for electron travel time across a barrier, and the Schroedenger equation is considered for an electron in a variable electrical field. The probability of the transition of the electron from its fundamental state to the state described by the wave function in the dipole approximation is calculated, with the effect of the electrical field taken into account. The matrix element of a transition directly from the fundamental state to the continuous spectrum is formulated, and the expression for a matrix transition element is obtained. The law of conservation of energy for the multiphoton process is expressed. A table is included on the various values of the probability of ionization as a function of the external field intensity, and of the number of absorbed quanta.
M.G.J.

N66-29230# Naval Postgraduate School, Monterey, Calif.
NUMERICAL COMPUTATION OF IMAGE SIZE AND DISTANCE FOR CONVERGING CHARGED PARTICLE BEAMS
H. B. Haskell, O. Heinz, and P. C. Johnson Apr. 1966 34 p refs
(TR/RP-55; AD-632088) CFSTI: HC $2.00/MF $0.50

In this paper are presented the results of numerical computations of the effect of space charge upon the image size and image distance in a converging beam of charged particles. The minimum beam radius (image size) and its position (image distance) are plotted as a function of beam perveance ranging from 10^{-13} to 10^{-6}. The beam convergence angle was varied from about 0.03 to 0.15 radians and calculations were carried out for 3 values of aperture radius (0.1 cm, 0.25 cm and 0.50 cm). The results are given for electrons, $^{1}H^{+}$, $^{7}Li^{+}$, $^{30}Ne^{+}$, and $^{85}Rb^{+}$
Author (TAB)

N66-29263# Emmanuel Coll., Boston, Mass. Oriental Science Library.
ON THE BRUECKNER-GOLDSTONE LINKED CLUSTER EXPANSION FORMULA
Shi-shu Wu Bedford, Mass., AFCRL, Feb. 1966 29 p refs Transl. into ENGLISH from Wu-li Hsueh-Pao (Peking), v. 20, no. 2, 1964 p 147–158
(Contract AF 19(628)-5073)
(EMM-65-27; AD-632410) CFSTI: HC $2.00/MF $0.50

It is shown that in the case of one particle outside or one hole inside a closed shell, a linked cluster expansion formally identical with that for a closed shell with all self-energy diagrams eliminated can be obtained even if there is degeneracy.
Author (TAB)

N66-29266# Emmanuel Coll., Boston, Mass. Oriental Science Library.
THE INTERACTION OF S-ELECTRONS WITH SPIN WAVES IN A FERROMAGNETIC
Sun Hsin Bedford, Mass., AFCRL, Mar. 1966 27 p refs Transl. into ENGLISH from Wu-li Hsueh-Pao (Peking), v. 20, no. 3, 1964 p 193–206
(Contract AF 19(628)-5073)
(EMM-65-38; AD-632411) CFSTI: HC $2.00/MF $0.50

In this paper, the emission and absorption of spin waves by S-electrons and the attenuation of spin waves caused by the interaction of s-electron and spin-wave scattering are computed using the double-time Green function. The results show that at low temperatures, only those waves with wave vectors at $10^6<k<10^8$ are emitted or absorbed by s-electrons. The attenuation of waves thus produced is much greater than that caused by spin-wave interaction. The attenuation due to scattering of spin waves by s-electrons is less than that due to the scattering of spin waves among themselves. It is therefore possible that there is an absorption band at $10^6<k<10^8$. Author (TAB)

N66-29285# Naval Radiological Defense Lab., San Francisco, Calif.

RADIONUCLIDE FRACTIONATION IN AIR-BURST DEBRIS

Edward C. Freiling and Michael A. Kay 14 Jan. 1966 17 p refs

(Contract AT(49-7)-1963)

(USNRDL-TR-933; AD-626608) CFSTI: HC $1.00/MF $0.50

Radiochemical data from fractionated samples of airburst debris are correlated logarithmically. The correlation slopes are measures of volatility. These are compared with slopes observed in the cases of high-yield surface bursts and with thermodynamic calculations of volatility. Author

N66-29311# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.

RESULTS WITH PHOSPHATE GLASS DOSEMETERS IN PERSONNEL DOSIMETRY

H. Kiefer, R. Maushart, and E. Piesch Oct. 1965 16 p refs Transl. into ENGLISH from Atompraxis (Germany), v. 11, no. 2, 1965 p 88–93

(AERE-TRANS-1046) CFSTI: HC $1.00/MF $0.50

This report discusses the use of glass dosimeters for radiation detection, the method for their evaluation, and their properties. The properties examined are energy dependence, orientation dependence, dose range, dose rate dependence, change of measure value after exposure, temperature effect during irradiation, scatter of measured values, and sensitivity to neutron radiation. As regards recording, storage, and reproduction of measured values, the glasses meet all present requirements for long term dosimeters. The dosimeter is inextinguishable which gives it the advantage of being ready for use again after a measurement and of permitting intermediate readings. For a one year monitoring period, the lower dose detection limit for a single glass dosimeter, even if read every fortnight, is 40 mR/year. For a better comparison with other personnel dosimeters, the principal properties of glass dosimeters are tabulated. R.N.A.

N66-29319# Atomic Weapons Research Establishment, Aldermaston (England).

MEASUREMENT OF THE CRITICAL MASS OF 37 1/2% ENRICHED URANIUM IN REFLECTORS OF WOOD, CONCRETE, POLYETHYLENE AND WATER

R. C. Lane and O. J. E. Perkins Feb. 1966 26 p refs

(AWRE-NR1/66) HMSO: 7s

This report describes the experimental arrangements used in ATLAS, a vertical assembly machine, for measurement of the critical mass of 37 1/2% enriched uranium in reflectors of wood, concrete, polyethylene and water. Data obtained are reported and discussed. Author

N66-29380*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE EXTREMA-EFFECT IN TOTAL ELASTIC MOLECULAR BEAM SCATTERING CROSS SECTIONS FOR CHARACTERIZATION OF THE POTENTIAL WELL

R. B. Bernstein and T. J. P. O'Brien 5 Jun. 1965 24 p refs Presented at the Gen. Discussion of the Faraday Soc. on Intermol. Forces, Bristol Univ., England, 14–16 Sep. 1965

(Grant NsG-275-62)

(NASA-CR-67564; WIS-TCI-100) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The theory of the extrema-effect in elastic impact spectra is reviewed and extended. It has been shown previously that for any realistic inter-particle potential (whose well has a capacity for one or more bound states), extrema in the total elastic molecular beam scattering cross sections are expected at certain characteristic velocities. The limiting high-velocity spacing of successive extrema on a 1/v plot is found to be inversely proportional to the product of the well depth ϵ times the inter-particle separation r_m at the potential minimum. It is shown that the constant of proportionality is closely related to the curvature of the well, and thus to the force constant of the di-atom (or "complex" molecule). Methods are discussed for the extraction of the maximum amount of information on the shape of the potential well from measurements of the extrema-effect. Author

N66-29416*# National Aeronautics and Space Administration, Washington, D. C.

THE ISOTOPIC SPIN OF LIGHT NUCLEI

A. Baz' and Ya. Smorodinskiy Feb. 1963 59 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (USSR), v. 55, no. 2, Feb. 1955 p 215–264

(NASA-TT-F-8402) CFSTI: HC $3.00/MF $0.50 CSCL 20H

The spectral structure of the light nuclei is examined from the viewpoint of their inherent tendencies resulting from the acceptance of the hypothesis of charge independence. The structure of the nuclear spectra itself provides the most convincing proof of the validity of the hypothesis under consideration, at least in the lower energy region. This review attempts to show which general properties of the spectra are connected with the hypothesis of charge independence, and what conclusion may be made about the accuracy of that hypothesis. The basic physical ideas used as a basis for the development of the isotopic spin theory are outlined. The levels of light nuclei are described and their isotopic spin is analyzed. R.N.A.

N66-29422*# Consultants and Designers, Inc., Arlington, Va.

ROLE OF THE POLARIZATION EFFECTS AT INELASTIC COLLISIONS OF ELECTRONS WITH ATOMS [ROL' POLYARIZATSIONNYKH EFFEKTOV PRI NEUPRUGIKH STOLKNOVENIYAKH ELEKTRONOV S ATOMAMI]

G. F. Drukarev and V. D. Obyedkov Oct. 1963 14 p refs Transl. into ENGLISH from Atomnyye Stolknovehiya (Riga), v. 13, 1963 p 55–65

(Contract NAS5-2078)

(NASA-TT-F-8632; ST-NPH-1054) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Equations are formulated that take into account the virtual transitions, which include the standard system of equations, as a particular case. In order to find the obvious form of polarization potential in the adiabatic approximation, it is proposed that the corresponding variation principle be utilized. Equations are derived; the polarization potentials are computed; and the dependence of excitation cross section on energy is demonstrated. R.T.K.

N66-29423*# Consultants and Designers, Inc., Arlington, Va.
RADIAL EQUATIONS OF THE THEORY OF ATOMIC COLLISIONS [RADIAL'NYYE URAVNENIYA TEORII ATOMNYKH STOLKNOVENIY]
L. A. Vaynshteyn Oct. 1963 23 p refs Transl. into ENGLISH from Atomnyye Stolknoveniya (Riga), v. 13, 1963 p 67–86
(Contract NAS5-2078)
(NASA-TT-F-8631; ST-NPH-10053) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The polarization potential for elastic and inelastic scattering is discussed using the standard system of radial equations as a basis of discussion and the method of consecutive approximations to obtain solutions. General systems of radial equations, representation of distorted waves, representation of the elastic scattering, and approximations of two states are discussed in introducing the polarization potential. Two approaches to approximate representations of the polarization potential are discussed: (1) approximations of the second order and (2) adiabatic approximations. Disruption of adiabaticity is also discussed. P.V.E.

N66-29437*# Massachusetts Inst. of Tech., Cambridge.
COLLISION INDUCED TRANSITIONS WITHIN EXCITED LEVELS OF NEON
J. H. Parks and A. Javan [1964] 30 p refs
(Grant NsG-330)
(NASA-CR-60387) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The interaction of an intense optical maser field with excited atoms in a gas discharge leads to a considerable change in the population of those levels which are resonant at the maser frequency. This will cause a change in the population of other levels that are connected to the maser levels through collision induced non-radiative as well as radiative transitions. Using the 1.15μ maser, these effects have been studied in detail for the 2s levels of neon where the changes are completely due to collisions. By analyzing the intensity changes in spontaneous emission originating from a gas discharge cell placed within the maser resonator, we have been able to obtain the atomic collision cross section for excitation transfer between the $2s_2$ and $2s_3$ levels. In pure neon this has been found to be $\sigma_{23} = 2.3 \pm .3 \times 10^{-16}$ cm^2. For a helium–neon mixture the measured cross section is $\sigma_{23} = 1.8 \pm .3 \times 10^{-16}$ cm^2. The experimental method used to determine these cross sections eliminates the uncertainties caused by the effects of electron atom collisions and radiative cascade. Author

N66-29440*# National Aeronautics and Space Administration, Washington, D. C.
STATE OF THE ART AND CERTAIN NEW DEVELOPMENTS IN THE MOLECULAR BEAM METHOD [SOUREMENNOYE SOSTOYANIYE I NEKOTORYYE NOVYYE REZUL'TATY METODA MOLEKULYARNOGO PUCHKA]
V. B. Leonas May 1964 58 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 82, no. 2, 1964 p 287–323
(NASA-TT-F-8879) CFSTI: HC $3.00/MF $0.50 CSCL 20H

Fundamental principles of experimental devices for the measurement of molecular beams are discussed, and some problems encountered in practical applications are considered in a general review. Various methods of creating, recording, and selecting molecular beams are discussed; along with applications for the solution of specific problems encountered in molecular and chemical physics. Use of molecular beams in the study of phenomena accompanying escape into a vacuum is detailed, as is the study of the interaction between molecules and the surface of a solid. Consideration is given to furnace-type, gas-dynamical, charge transfer, atomization, molecular catapulting, beam pulsation sources of molecular beams. M.W.R.

N66-29462*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
COLLISION FREQUENCIES AND ENERGY TRANSFER-ELECTRONS
Peter M. Banks 1 May 1966 41 p refs *Its* Sci. Rept.-271
(Grant NsG-134-61)
(NASA-CR-75889) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The problem of elastic collisions and energy transfer between gases which have separate Maxwellian velocity distributions is studied. It is shown that the expression for the energy transfer rate obtained by Desloge for gases of arbitrary temperature and particle mass can be adapted into a convenient form which involves a ratio of the particle masses, the difference in the gas thermal energies, and a collision frequency for energy transfer. An analysis is made of the collision frequency in terms of an average momentum transfer cross section which is defined for conditions of thermal nonequilibrium. The general equations are specialized to consider the problem of elastic electron collisions in heavy particle gases. To obtain useful numerical expressions for electron–neutral particle collision frequencies and energy transfer rates, an analysis is made of the momentum transfer cross sections for N_2, O_2, O, H, and He. Calculations are also made of the Coulomb momentum transfer cross section, collision frequency, and energy transfer rate. Author

N66-29473*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF THE MULTI-CONFIGURATION APPROXIMATION TO THE DETERMINATION OF THE DIPOLE FORCE FOR ATOMS OF THE BERYLLIUM AND BORON TYPES [PRIMENENIYE MNOGOKONFIGURATSIONNOGO PRIBLIZHENIYA PRI OPREDELENII SILY DIPOLA DLYA ATOMOV TIPA BERILLIYA I BORA]
A. B. Bolotin and A. P. Yutsis Jun. 1963 19 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 24, 1953 p 537–544
(NASA-TT-F-8446) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Expressions are presented for the total dipole force for $1s^22s2p$ to $1s^22s^2$ transitions of atoms of the beryllium type and $1s^22s2p^2$ to $1s^22s^22p$ transitions of atoms of the boron type in a two-configuration approximation. The constants of the analytic single-electron wave functions are determined for the atoms B, C^+, N^{++}, O^{+3} and F^{+4} in the $1s^22p^3$ and $1s^22s2p^2$ configurations. The analytic single-electron wave functions are used to determine values of the total dipole force, the oscillator strength, and the transition probability for $1s^22s2p$ to $1s^22s^2$ transitions of the atoms Be, B^+, C^{++}, N^{+3} and O^{+4}, and for $1s^22s2p^2$ to $1s^22s^22p$ transitions for the atoms B, C^+, N^{++}, O^{+3} and F^{+4} Author

N66-29474*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ON VAINSHTEIN'S METHOD APPLIED TO THE ELECTRON IMPACT EXCITATION AND IONIZATION OF ATOMS
Kazem Omidvar Jun. 1966 24 p refs
(NASA-TM-X-55501; X-641-66-245) CFSTI: HC $1.00/MF $0.50 CSCL 20H

In previous papers Vainshtein and collaborators have introduced a method of calculation which in some respects gives better agreement with observation than do other methods. In their derivation the integral for the excitation and ionization amplitudes is treated approximately. In this paper this integral is derived exactly, and it is shown that an overall improvement in agreement with observation is obtained. The theory has some features in common with the close-coupling approximation. In particular, at the threshold of excitation and

ionization the cross section has oscillatory behavior. A feature of the theory not presently understood is that the exchange amplitude is indeterminate. Author

N66-29496# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
NUCLEAR BREMSSTRAHLUNG FROM 140 MeV PROTONS
J. A. Edgington (Cambridge Univ.) and B. Rose Feb. 1966 38 p refs
(AERE-R-5167)

Differential cross sections and rough energy spectra for bremsstrahlung production have been measured under 140 MeV proton bombardment of H, D, Be, C, N, O, Al, Cu and Pb. The total cross section per neutron in the target nuclei for photons above 40 MeV varied from ~4 1/2 μb to ~2 μb from D to Pb. The observed cross section for the p-p system was -0.06 ± 0.05 μb. The data from nuclei is in reasonable agreement with the limited experimental data available and with the theory of Beckham. The p-p value is much lower than any theoretical estimate. Author

N66-29497# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
A NOTE ON DOUBLE BREMSSTRAHLUNG
P. di Vecchia 30 Mar. 1966 10 p refs *Its* Nota Interna No. 316
(LNF-66/17) CFSTI: HC $1.00/MF $0.50

Processes for monitoring the common volume of the colliding beams in an electron positron storage ring were considered. One experiment revealed the existence of a continuous spectrum for the sum of two gamma rays. This continuum was attributed to the process of double bremsstrahlung, and an equation for this process is given. Some points in favor of adopting this process as a monitoring process are given, however, it is stated that neither the total nor the differential cross section of the process have been determined theoretically. A formula for small energies of the emitted γ's is given, and a method for obtaining information about the high energy behavior of the process is discussed. H.S.W.

N66-29498# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
NUCLEAR PHYSICS DIVISION Progress Report, 1 Mar.–31 Oct. 1965
D. L. Allan, ed. Feb. 1966 58 p refs
(AERE-PR/NP-9)

Nuclear physics technological advancements are reported on the following topics: elastic and inelastic neutron scattering from Pu^{239} (IBIS); nuclear data for reactors, including cross section neutron and fission measurements; integral data measurements of fast neutron spectra in materials and from the neutron booster. Used in basic research on nuclear structure and dynamics was the following equipment: pulsed Van de Graaff accelerator, 5 MV Van de Graaff generator, 12 MeV tandem generator, 45 MeV electron linear accelerator, 50 MeV proton linear accelerator, and the synchrocyclotron. Nimrod power experiments include investigation of the decay of the f^0-meson and K^0_2 decay into charged and neutral pions. Other studies in physics were made on the Mossbauer effect, Cherenkov radiation, and an image intensified for astronomical spectroscopy. Accelerator operation and maintenance, and miscellaneous techniques are mentioned. R.Ll.

N66-29542# Polish Academy of Sciences, Warsaw.
HARD CORE NUCLEON SYSTEM WITH NEUTRON EXCESS [SYSTEM NUKLEONOW ODZIALYWUJACYCH RDZENIEM ODPYCHAJACYM W PRZYPADKU NADMIARU NEUTRONOW]
Janusz Dabrowski and M. Y. M. Hassan Oct. 1965 35 p refs
(INR-662/VII/PH) CFSTI: HC $2.00/MF $0.50

The known expansion of the ground state energy of a system of hard core fermions in powers of $k_F c/k_F$ = Fermi momentum, c = hard core radius is extended to include the case of nuclear matter with a neutron excess and the case of one kind of fermions (e.g. liquid He^3) with a spin up excess. The calculation includes terms quadratic in $k_F c$. Expressions for the nuclear symmetry energy and the spin symmetry energy are given. An approximation applied earlier by Brueckner et al. in computing both of these quantities is discussed. Author

N66-29551# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
POLARIZATION IN HIGH-ENERGY π-PROTON ELASTIC AND CHARGE-EXCHANGE SCATTERING
M. Le Bellac Apr. 1966 13 p refs
(TH/145)

Experimental results on polarization in high-energy $\pi^- - P$ elastic scattering are compared with predictions of the Byers-Yang model, and the polarization is calculated for $\pi^+ - P$ scattering and $\pi^- P \rightarrow \pi^0 N$ above 6 GeV/C. Author

N66-29578# Oak Ridge National Lab., Tenn.
OGRE, A MONTE CARLO SYSTEM FOR GAMMA-RAY TRANSPORT STUDIES, INCLUDING AN EXAMPLE (OGRE-P1) FOR TRANSMISSION THROUGH LAMINATED SLABS
S. K. Penny, D. K. Trubey, and M. B. Emmett Apr. 1966 34 p refs
(Contract W-7405-ENG-26)
(ORNL-3805) CFSTI: HC $2.00/MF $0.50

A system of computer subroutines (called OGRE) was designed for the study of gamma-ray transport by the Monte Carlo method. The various steps of the procedure were isolated so that a complete code to solve a specific problem may be easily synthesized. A cross section system which is easy to use is included. A specific example of the system's use (OGRE-P1) which computes the dose rates from gamma rays penetrating laminated slabs is included. Author (NSA)

N66-29582# Atomics International, Canoga Park, Calif.
THE CALCULATION OF SLOWING-DOWN TRANSFER MATRICES IN THE SPHERICAL HARMONICS REPRESENTATION
Bruce D. O'Reilly and Richard C. Lewis 25 Mar. 1966 83 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11530) CFSTI: HC $3.00/MF $0.75

The calculation of transfer matrices for use in multigroup spherical harmonics calculations is discussed. The defining equations are derived from considering the slowing-down source of neutrons in the spherical harmonics representation. Both elastic and inelastic scattering processes are accounted for. Two complementary procedures are used to calculate the matrix elements for inelastic scattering: (1) the discrete level model, and (2) the Weisskopf evaporation model. Elastic scattering is accounted for by the discrete level model with zero threshold energy. Particular attention was given to

describing the differential angle–energy cross section for neutrons exciting a discrete energy level of the target nucleus. The usually neglected double-valued relation between incident and emergent energies in the laboratory frame, which exists when the incident energy approaches closely to the threshold energy, is taken into account. Neutron balance conditions are found for the group-averaged slowing-down current and for the group averages of the higher-ordered Legendre coefficients of the slowing-down distribution, as well as the usual balance condition for the scalar slowing-down flux. It is found that the transitions of neutrons incident in the double-valued region contribute negligibly to the overall neutron balance. A sample calculation of the P_0-matrix for ^{12}C in a 16-group structure is also given. The sample calculation is carefully analyzed with respect to the effects of numerical approximations on the accuracy of computed matrix elements. A number of numerical procedures are recommended for improving the accuracy of transfer matrix calculations. Methods are discussed for obtaining estimates of spectra appropriate to critical reactors, reactor kinetics, and shields. Author (NSA)

N66-29596# New York Univ., N. Y. Dept. of Physics.
CALCULATIONS IN ATOMIC SCATTERING PROBLEMS AND ATOMIC STRUCTURE Final Report, 1 May 1960–1 Feb. 1966
Sidney Borowitz 31 Mar. 1966 10 p refs
(Contract Nonr-285(49))
(AD-630172) CFSTI: HC $1.10/MF $0.50

Results of studies in the following areas are briefly summarized: (1) derivation of the Thomas–Fermi atomic model from the main body of the Schrodinger equation; (2) low energy scattering of electrons and positrons by atoms; (3) high energy scattering of electrons by atoms. A bibliography of the 46 papers resulting from the studies is included. TAB

N66-29606# California Univ., Livermore. Lawrence Radiation Lab.
NEUTRON–NEUTRON INTERACTION IN THE T+T REACTION
B. Lacina, J. Ingley, and D. W. Dorn 26 Jan. 1965 24 p refs
(Contract W-7405-ENG-48)
(UCRL-7769)

The effects of a final-state neutron–neutron interaction in the reaction $\tau+\tau \rightarrow {}^4He+2n+Q$ (11.33 MeV) are studied. It is shown that the energy spectra peak is near Q/3 if a square-well interaction is assumed. NSA

N66-29612# Syracuse Univ., N.Y. Dept. of Physics.
DIRAC MATRICES AND THE DIRAC MATRIX DESCRIPTION OF LORENTZ TRANSFORMATIONS
A. J. MacFarlane [1965] 23 p refs
(Contract AT(30-1)-3399)
(NYO-3399-43) CFSTI: HC $1.00/MF $0.50

Dirac matrices and the Dirac-matrix description of Lorentz transformations are discussed. The five anticommuting quantities γ^J (J = 1,2,3,0,5) are treated on an equal footing and recognition of the rule for expressing the three-fold product $\gamma^J\gamma^K\gamma^L$ in terms of one- and two-fold products and of invariant "five-space" tensors g^{JK}, ϵ^{JKLPQ} allows all kinds of multiplication and trace laws for Dirac matrices to be derived systematically. The "five-space" formalsim for Dirac matrices affords a very convenient vehicle for the Dirac matrix description of certain de Sitter transformations. By considering the subset of these that leaves the coordinate x^5 invariant, the Dirac matrix description of Lorentz transformations is obtained. Not only does this description give the formula for any Lorentz transformation matrix L in terms of the matrix S, which enters the transformation law of a Dirac spinor $\psi(x)$ under L, but it also gives an explicit inverse formula expressing S in terms of L. Author (NSA)

N66-29616# Argonne National Lab., Ill.
NEUTRON POLARIZATION IN THE REACTION D(D,N)^{3}HE AT LOW DEUTERON ENERGIES
H. Haenagen, H. Pose, G. Schirmer, and D. Seeliger Sep. 1965 9 p refs Transl. into ENGLISH from Nucl. Phys., v. 73, 1965 p 417–423
(ANL-TRANS-265)

The polarization of neutrons emitted from the reaction $D(d,n)^3He$ at an angle of 50° in the laboratory system was measured at eight deuteron energies from 57.3 to 116.8 keV. The neutron polarization was calculated from the measured left-right asymmetry in the elastic scattering of the neutrons from carbon. The polarization exhibits resonance behavior in the energy range covered and attains a maximum at 80 keV. NSA

N66-29617# International Centre for Theoretical Physics, Trieste (Italy).
EVALUATION OF THE $N^*_{33}N$ WEAK COUPLING CONSTANTS BY MEANS OF CURRENT ALGEBRA
G. Furlan, R. Jengo (Trieste Univ.), and E. Remiddi Feb. 1966 9 p refs
(IC/66/13)

The form factors of the $N^*_{33}N$ weak axial vectors are expressed in terms of the vector and axial vector form factors of the nucleon. A relation between the $N^*_{33}N\pi$ and $NN\pi$ coupling constants and an estimate of the mass of a hypothetical 1^+ meson are also obtained. Author (NSA)

N66-29618# Duetsche Akademia der Wissenschaften zu Rossendorf (East Germany).
GAMME TRANSITIONS IN ^{153}EU [GAMMA-UEBERGAENGE IM ^{153}EU]
L. Funke, H. Graber, K.-H. Kaun, H. Sodan, J. Frana et al (Kernforschung Inst., Rez) Dec. 1965 11 p refs In GERMAN; ENGLISH summary
(ZfK-PhA-18)

The gamma spectrum of Sm^{153} was measured using a Li-drifted Ge detector. The gamma energies and intensities were compared with values obtained from an investigation of the external conversion electron spectrum. Previously unreported gamma rays with energies of 509, 617, and 657 kev were observed. It is proposed that the 681.6- and 694.3-kev levels of Eu^{153} are the beta-vibrational levels corresponding to the one-particle levels $5/2^+[413]$ and $3/2^+(411)$, respectively. NSA

N66-29621# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF RESONANCE ABSORPTION INTEGRALS (MN, FE, CO, NI, CU, ZR, MO) [MESURE DES INTEGRALES DE RESONANCE D'ABSORPTION (MN, FE, CO, NI, CU, ZR, MO)]
Rene Vidal and Eduardo Cardoso-Martinho Nov. 1965 43 p refs In FRENCH
(CEA-R-2840)

The measurements were carried out with the oscillation technique, without a cadmium tube, in a spectrum rich in epithermal neutrons. The samples consist in metal plates or deposits on aluminum. Results are presented. NSA

N66-29623# Ohio State Univ. Research Foundation, Columbus.
SUPPORT OF K-MESON EXPERIMENTS AT THE ZGS Final Report, 1 Feb. 1963–30 Sep. 1965
T. A. Romanowski and Kurt Reibel Dec. 1965 11 p refs
(Contract AT(11-1)-1261)
(COO-1261-22) CFSTI: HC $1.00/MF $0.50

Brief summaries of various activities of the OSU group during this period are presented. The ZGS beam survey and the extracted proton beam studies involved counters, as does the K production cross section experiment. The Ke_2 and $\Lambda\beta$ experiments make use of counters and spark chambers and considerable effort has gone into the instrumentation of these experiments. Also, OSU personnel became involved in the data analysis of the ANL-CERN spark chamber exposure, first at ANL and later, using the spark chamber and bubble chamber data processing system, at OSU. Finally, a development of digitized spark chamber systems with magnetostrictive readout was initiated. Theorists investigated various mechanisms of the breaking of SU_3 symmetry. In particular, a consequence of the symmetry breaking interaction that transforms as the I=Y=0 member of 27 representation was found, and also some rules among the axial vector coupling constants were derived when symmetry breaking interaction is taken into account. In weak interactions, the universality in the strength of strong coupling of the vector meson K* with all strangeness changing F type vector current was derived, the $\Delta Q=0$, $\Delta S=1$ component of unitary spin current combined with symmetry arguments was exploited in rare decay modes of hadrons, and the nonleptonic K° decay was examined on the basis of CPT theorem and unitary symmetry without the requirement of CP invariance. In addition, the decay widths of the radiative decay mode of vector mesons were calculated in SU_6 were applied to pseudoscalar meson states with the conclusion that strong $\pi^-\pi^+$ and π^-K^+ interactions should exist in the low energy region. Author (NSA)

N66-29624# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE ABSOLUTE MEASUREMENT OF ACTIVITY OF ELECTRON CAPTURE NUCLIDES. DETERMINATION OF THE FLUORESCENCE YIELD OF SOME ELEMENTS [CONTRIBUTION A LA MESURE ABSOLUE DE L'ACTIVITE DES ISOTOPES SE DESINTEGRANT PAR CAPTURE ELECTRONIQUE. DETERMINATION DU RENDEMENT DE FLUORESCENCE DE QUELQUES ELEMENTS]
Jean Legrand (Thesis) Sep. 1965 56 p refs In FRENCH
(CEA-R-2813)

The object of this work is the study of techniques of measurement of the absolute activity of electron capture nuclides. Two methods are specially studied. The first comprises determination of the number of X-rays emitted from the k shell due to the reorganization of atomic electrons following electron capture. This measurement is made with a high pressure (5 kg/cm^2) 4 π proportional counter. The absorption in the source and the backing are also studied. To determine the absolute activity it is necessary to know the fluorescence yield and the different capture probabilities P_L and P_K. When the electron capture is followed by γ emission (within the resolution time of the coincidence circuit) the activity is determined by the X–γ coincidence method. In such a case it is not necessary to know the fluorescence yield and the capture probabilities. Various corrections, viz. dead time and chance coincidences, are also studied. This method minimizes the decay scheme corrections. By applying these two methods to ^{51}Cr, ^{54}Mn, and ^{65}Zn, the corresponding fluorescence yields are determined. Author (NSA)

N66-29625# California Univ., Livermore. Lawrence Radiation Lab.
CHARGE TRANSFER CROSS SECTIONS FOR H^+, H_2^+, OR H_3^+ ON H_2 FROM 2 TO 55 KEV
E. S. Chambers 26 Feb. 1965 21 p refs
(Contract W-7405-ENG-48)
(UCRL-6987, Rev. 1) CFSTI: HC $1.00/MF $0.50

Electron capture cross sections for H^+, H_2^+ and H_3^+ ions colliding with H_2 gas were obtained by measuring the fast neutrals produced. Ion energy ranged from 2 to 55 kev. The H^+ results agree with previous work at all energies. Electron capture cross sections for the molecular ions were obtained after correcting for dissociation. The effect of using vibrationally excited ions was also studied. Such ions gave about 10% more neutrals. With excited H_3^+, a change in source conditions that increased the dissociation to H_2^+ by a factor of 1.7 only caused a ±5% change in the total number of neutrals, while a change of 21% was expected. This suggests that under these conditions the electron capture decreases as the dissociation increases. The electron capture of H_2^+ produced from H_3^+ was studied. The production of negative ions by collision was investigated. Author (NSA)

N66-29700# Stanford Univ., Calif. High Energy Physics Lab.
CHARGED PION YIELDS FROM e^-+p REACTIONS
S. P. Berezin, P. C. Gugelot, and P. Heide Feb. 1966 19 p refs Presented at the Intern. Symp. on Electron and Photon Interactions at High Energies, Hamburg, 8–12 Jun. 1965
(Contract Nonr-225(67))
(HEPL-424; AD-632543) CFSTI: HC $1.00/MF $0.50

Charged pion yields from the reactions $e^-p \rightarrow e^-n\pi^+$ and $e^-p \rightarrow e^-p\pi^{+-}$ were measured in the region of the N* resonance. It is shown that for the single pion reaction the cross section can be understood in terms of a virtual photon which is almost transverse and can be fit by a virtual bremsstrahlung spectrum plus photoproduction results. Author (TAB)

N66-29707*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A FORECAST FOR THEORETICAL CHEMISTRY
Joseph O. Hirschfelder 28 Mar. 1966 38 p refs Presented at Am. Chem. Soc. Meeting, Pittsburgh, 28 Mar. 1966
(Grant NsG-275-62)
(NASA-CR-75985; WIS-TCI-171) CFSTI: HC $2.00/MF $0.50
CSCL 07D

Application of molecular quantum mechanics and statistical mechanics in theoretical chemistry is emphasized. The use of Slater screening constants makes it possible to estimate the energy or almost any physical property of an atom. High speed computers can be utilized to calculate the energy of a large number of diatomic and triatomic molecules; these molecular energies can then be applied to large scale calculations of potential energy surfaces and predicted chemical reaction rates. Potential energy surfaces can also be constructed by using the Born–Oppenheimer separation theory of electronic and nuclear motions in molecular beams. Quantum electrodynamic equations have to be considered for second order effects of nuclear magnetic resonance, laser optics, microwave line shapes, etc. The growth of crystals and the theory of nucleation are other fields of theoretical research that also requires statistical mechanics. G.G.

N66-29719# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CORRELATION OF RADIATION DAMAGE IN BORONATED GRAPHITE

R. E. Dahl Feb. 1966 36 p refs
(Contract AT(45-1)-1830)
(BNWL-199) CFSTI: HC $2.00/MF $0.50

The number of atom displacements caused by fast neutrons and through the nuclear reaction of ^{10}B with thermal neutrons was calculated. An analysis was also made of the effect of whether B was in solid solution or as B_4C. The relative damaging ratio of fast neutron displacements to those caused by the $^{10}B(n,\alpha)^7Li$ reaction was correlated with data on the dimensional changes of boronated graphite exposed in several reactors having neutron spectra with different fast neutron to thermal neutron ratios. NSA

N66-29767# Bettis Atomic Power Lab., Pittsburgh, Pa.
SHREW—A FORTRAN CODE FOR COMPUTING ANGULAR DISTRIBUTIONS, POLARIZATIONS AND TRANSPORT CROSS SECTIONS OF NEUTRONS SCATTERED BY SPINLESS TARGETS
M. Goldsmith and S. L. Raspotnik Dec. 1965 13 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-524) CFSTI: HC $1.00/MF $0.50

SHREW uses phase shifts to compute elastic scattering cross sections employed in neutron transport codes. Polarizations and angular distributions, essential in checking the accuracy of the input phase shifts, are also calculated as is the modification of the transport cross section caused by neutron polarization. Output may be either printed or punched on cards which are used to prepare a ROC record. Author (NSA)

N66-29768# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE FLUCTUATIONS OF THE PARTIAL AND TOTAL RADIATIVE WIDTHS BY NEUTRON CAPTURE RESONANCE [ETUDE DES FLUCTUATIONS DES LARGEURS RADIATIVES PARTIELLES ET TOTALES PAR LA CAPTURE DES NEUTRONS DE RESONANCE]
Huynh Vinh Dinh (Ph.D. Thesis—Paris Univ.) 18 Jun. 1965 105 p refs In FRENCH
(CEA-R-2810)

The distributions of partial radiative widths, the effects of correlation between different radiative transitions, fluctuations of total radiative widths Γ_γ from resonance to resonance, the variation Γ_γ with the mass number, and the existence of potential capture were studied using time-of-flight techniques. NSA

N66-29769# Brookhaven National Lab., Upton, N. Y.
WAVE FUNCTIONS FOR QUADRUPOLE ANTISHIELDING FACTORS
R. M. Sternheimer Jan. 1965 28 p refs
(Contract AT(30-2)-GEN-16)
(BNL-8850) CFSTI: HC $1.00/MF $0.50

Some perturbed wave functions that were obtained in a calculation of the quadrupole antishielding factors for Al^{3+}, Cs^+, Cl^-, I^-, Pr^{3+}, and Tm^{3+} are tabulated. Perturbation by the nuclear quadrupole moment is taken into account. NSA

N66-29771# Purdue Univ., Lafayette, Ind. Dept. of Physics.
BETA-GAMMA CIRCULAR POLARIZATION CORRELATION OF ^{122}Sb
Z. W. Grabowski, R. S. Raghavan, and R. M. Steffen [1964] 14 p refs
(Contract AT(11-1)-1420)
(COO-1420-112) CFSTI: HC $1.00/MF $0.50

The angular dependence of the circular polarisation of the 566-kev gamma radiation following the first-forbidden 1400-kev β transition of ^{122}Sb is studied. The β–γ circular polarization correlation is consistent with a cos θ dependence. The data confirm that shape and the angular correlations of the 1400-kev β transition of ^{122}Sb are well described by the Coulomb approximation. The ratio of scalar type to vector type matrix element components in this β-transition is studied. The β–γ circular polarization correlation results obtained make possible the reduction of the number of solutions obtained for the six nuclear matrix elements which enter into the $2^- \rightarrow 2^+$ 1400-kev β transition of ^{122}Sb. Author (NSA)

N66-29772# Oak Ridge National Lab., Tenn.
COMPUTATION OF THE THICKNESS OF WATER SHIELDS AGAINST GAMMA RADIATION
Arnost Hoenig [1966] 13 p refs Translated into ENGLISH from Inzenyrske Stavby (Czechoslavakia), no. 9, 1965 p 399–404
(ORNL-TR-1061)

Calculated gamma buildup factors for the does rate are given in detailed tables and diagrams, relative to water with a density of 1.00 g/cm^3. Author

N66-29774# Oak Ridge National Lab., Tenn.
GAMMA-RAY ATTENUATION COEFFICIENTS FOR GERMANIUM
G. T. Chapman 2 Mar. 1966 5 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1237) CFSTI: HC $1.00/MF $0.50

An interpolation method was used to determine the γ-ray attenuation coefficients of germanium. If the region of the atomic numbers, Z, is relatively small and the γ-ray energy is not too close to the k-shell energies for the elements in this range of Z, the attenuation coefficients will vary smoothly and not too drastically as a function of Z. Author (NSA)

N66-29778# Atomic Energy Centre, Dacca (Pakistan).
PION-NUCLEON COUPLING CONSTANT FROM SPIN-FLIP DISPERSION RELATION
A. M. Harun-Ar-Rashid, Md. Mazharul Islam, and Md. Hanifuddin Miah Jul. 1965 13 p refs
(AECD/TP-5)

A set of dispersion relations was used to calculate coupling constants for pion-nucleon scattering. The analysis is in terms of phase-shifts. NSA

N66-29779# Oak Ridge National Lab., Tenn.
PHASE-SHIFT ANALYSIS OF ELASTIC SCATTERING: THE CODE PEGGY
L. W. Owen 16 Mar. 1966 12 p
(ORNL-TM-1464) CFSTI: HC $1.00/MF $0.50

A least-squares search program was written in FORTRAN for the CDC-1604 computer which analyzes, in terms of phase shifts, the elastic scattering of spin zero and spin one-half particles by spin zero nuclei. Real or complex phase shifts may be used with or without spin-orbit coupling. Differential cross section and polarization angular distributions may be analyzed either separately or simultaneously. Author (NSA)

N66-29833# Naval Radiological Defense Lab., San Francisco, Calif.
CALCULATIONS OF THE ENERGY AND MASS YIELDS FROM THE THERMAL-NEUTRON FISSION OF U_{235}

James M. Ferguson and Philip A. Read 15 Mar. 1966 42 p refs
(USNRDL-TR-992; AD-632242) CFSTI: HC $2.00/MF $0.50

Improvements in a semi-empirical correlation of the energy and mass yield data for U^{236} fission are presented. The available mass, energy, and neutron emission data are correlated with each other within the accuracy of the input data. A simple model of the U^{236} fragments at scission is presented. This model, together with some experimental data, is used to predict the surface tension parameters of the fragments and kinetic energies of the fragment pairs. The calculated kinetic energies agree reasonably well with experiment. The surface tension parameters of the fragments show strong shell effects, as indicated in other studies. The shapes of the fragments at scission are estimated from the model. Author (TAB)

N66-29838# Princeton Univ., N. J. Frick Chemical Lab.
CORRELATION OF ELECTRONIC STRUCTURE AND BENDING FORCE CONSTANTS IN SOME LINEAR MOLECULES
William Hayden Smith and George E. Leroi Feb. 1966 14 p refs Submitted for Publication
(Contract Nonr-1858(48))
(TR-4; AD-632000) CFSTI: HC $1.00/MF $0.50

A qualitative relationship between electron density about the central carbon atom and ease of bending is described for several triatomic and pentatomic linear molecules, including CO_2, C_3, CN_2, C_3H_2, C_3N_2, C_3S_2, and C_3H_4. Both valence bond and molecular orbital models are discussed. Author (TAB)

N66-29904# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON AND ION EMISSION OF CERTAIN MATERIALS IN CONNECTION WITH THEIR UTILIZATION IN A THERMOELECTRON ENERGY TRANSFORMER
B. I. Mikhaylovs'kiy 29 Apr. 1966 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 7, no. 1, 1962 p 75–77
(FTD-TT-65-1614/1+2+4; AD-632312) CFSTI: HC $1.00/MF $0.50

An investigation was made of the temperature dependence of electron and ion emission of ThO_2, ZrC, and LaB_6 cathodes for thermoelectron energy transformers. Author (TAB)

N66-29923# Radiation Research Associates, Inc., Fort Worth, Tex.
GAMMA-RAY ENERGY AND ANGULAR DISTRIBUTIONS ABOVE AN INFINITE FALLOUT FIELD
R. L. French Bethesda, Md., Armed Forces Radiobiol. Res. Inst., Nov. 1965 105 p refs
(Contract DA-49-146-XZ-254)
(RRA-T43; AFRRI-CR65-3; AD-612030) CFSTI: HC $3.00/MF $0.75

Monte Carlo techniques were applied in a detailed study of the gamma radiation environment produced in air three feet above fallout uniformly distributed on a smooth ground surface. The basic computations included the energy and angular distributions of the scattered photon flux above monoenergetic plane isotropic gamma-ray sources for ten different source energies from 0.10 to 3.5 MeV. For each source of energy, the flux arriving at the receiver in each of ten energy intervals between 0.04 and 3.5 MeV and eighteen equal receiver angle intervals between 0 (nadir) and 180° (zenith) was calculated. Separate calculations were performed for the uncollided fluxes from the infinite plane isotropic source. The results of the monoenergetic calculations were combined to obtain energy and angular distributions of the photon flux from fallout of four different ages: 1.12 hours, 23.8 hours, 4.57 days, and 9.82 days. Comparisons with measured and previously calculated data, both for actual fallout fields and for simulated infinite plane sources, show favorable agreement. Author (TAB)

N66-29925# Radiation Research Associates, Inc., Fort Worth, Tex.
A COMPARATIVE STUDY OF RADIOACTIVE SOURCE ARRANGEMENTS FOR SIMULATING FALLOUT GAMMA RADIATION FIELDS
R. L. French Bethesda, Md., Armed Forces Radiobiol. Res. Inst., Nov. 1965 119 p refs
(Contract DA-49-146-XZ-254)
(RRA-T45; AFRRI-CR65-2; AD-612032) CFSTI: HC $4.00/MF $0.75

Monte Carlo techniques were used in a study of three basically different approaches to simulating the gamma radiation environment near the air/ground interface due to fallout uniformly distributed on the ground surface. The energy and angular distribution of the photon flux at a receiver 3 feet above the ground due to a Co^{60} point isotropic source also three feet above the ground and at separation distances of 100 to 800 feet was computed, and the results bore little resemblance to those from a uniform fallout field. Results computed for a receiver position three feet above idealized Co^{144}, Cs^{137}, and Co^{60} infinite plane sources on the ground indicated good simulation of the angular distribution of the gamma-ray dose and, except for energies greater than 1.25 Mev, reasonable simulation of the energy spectra from fallout. A third source arrangement, called the 'compact simulator', simulated the fallout gamma radiation environment equally well. In the compact simulator, an overhead slab of water acts as a reflector to simulate air scattering. Author (TAB)

N66-29980*# Illinois Univ., Urbana. Dept. of Physics.
RECOMBINATION LIFETIMES IN GAMMA-IRRADIATED SILICON
Ralph Allan Hewes (Ph.D. Thesis) Jun. 1966 188 p refs
(Grant NsG-228-62)
(NASA-CR-76090) CFSTI: HC $5.00/MF $1.25 CSCL 20H

The small-signal recombination lifetimes of minority carriers were measured as a function of temperature in silicon before and after irradiation at room temperature by cobalt 60 gamma rays. The resistivity of the boron doped samples ranged between 10 and 5000 ohm-cm, and the resistivity of the phosphorus doped samples was between 20 and 220 ohm-cm. Both crucible and floating zone grown materials were investigated. The experimental results indicated: (1) The recombination centers active in n-type silicon are not the same as those active in p-type silicon. (2) The recombination centers dominant in float-zoned material appeared to anneal at lower temperatures than those dominant in crucible-grown material. (3) The defects controlling the lifetime in n-type material appeared to be the A and E centers, located at $E_c-0.17$ and $E_c-0.4$ ev, respectively. (4) The defects controlling the lifetime in p-type material appeared to have energy levels at $E_v+.18$ ev and $E_c-.3$ ev. (5) There appeared to be no strong dependence of the introduction rates for the defects on resistivity. Data are also given to verify the Shockley–Read formula. L.E.W.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-28495*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EVOLUTION OF A PLASMA PUFF IN A LONGITUDINAL MAGNETIC FIELD
Samuel J. Moss Jan. 1966 74 p refs Sponsored in part by NASA
(Contract NOw-62-0604-c)
(NASA-CR-75683; TG-806) CFSTI: HC $3.00/MF $0.75 CSCL 20I

A hydromagnetic model of the evolution of a plasma puff in a B_z field has been used to analyze the characteristics of the plasma produced by the conical pinch gun. The analysis is based on fitting the signals induced in single turn magnetic pickup loops by the passing plasma. In the cases studied good fits to the signals have been achieved and the characteristic parameters of the plasma found. This analysis applied to plasma generated by the theta-pinch gun has not been successful. In the two cases studied, the lack of good fits is attributed to the presence of a sizable amount of trapped field in the puff which is present along the entire flight path through the B_z field. Author

N66-28667*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
DRIFT INSTABILITIES AND ELECTRON CYCLOTRON OSCILLATIONS FOR ARBITRARY PLASMA PRESSURE
Nicholas A. Krall and L. D. Pearlstein 1965 *In its* Theoret. Studies of Space Plasmas [1966] p 7–19 (See N66-28666 16-29)
(GA-6591)

Most of the familiar drift instabilities (flute, universal, etc.) were calculated in the limit β = (plasma pressure)/(magnetic pressure) = 0. In this limit the perturbed electric field is electrostatic, and the Vlasov equation is remarkably simplified. The β limit for validity of the electrostatic approximation depends on the particular mode considered and many present experiments fall outside the range. Two well known low frequency drift instabilities are examined at arbitrary β; the zero β regime is determined and stability criteria for larger values of β are derived. In addition, the influence of finite β on radiation at the electron cyclotron harmonics is examined. The finite Larmor radius (R) flute instability driven by mirror type curvature of the magnetic field is considered first. It is shown that the lowest order ominously large contribution, inversely proportional to R^2, cancels to all orders of β. The leading terms are then independent of R, and are included in the eigenvalue problem; stability criteria are obtained for various ranges of β Next the universal instability $\overline{E}_{Perturbed} = \overline{E} \exp(ik_\perp r_\perp)\exp(ik_{||}\eta_{||})$ in a uniform magnetic field $B = B_0\hat{e}_{||}$ is considered, simulating field curvature by a fictitious gravity. Here the zero β limit is dependent upon wavelengths. Author

N66-28668*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
FINITE β EFFECTS IN A WEAKLY UNSTABLE PLASMA
L. D. Pearlstein and Nicholas A. Krall 1965 *In its* Theoret. Studies of Space Plasmas [1966] p 21–43 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-6822)

The effect of finite plasma pressure (β) on the interchange mode is calculated in the finite Larmor radius limit. The method follows earlier zero β calculations of Rosenbluth and Simon, expanding the Vlasov equation with the ion Larmor radius a_i considered small as compared to the plasma radius, L. The plasma pressure is taken to be zero order in a_i/L. A differential equation is obtained for the stability properties of systems with arbitrary radial dependence of density, electric field, magnetic field and β. Several simple examples show that increasing β moves marginally flute unstable systems to stability, if the change in β does not include violent changes in the density and field profiles. Author

N66-28669*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
HIGH-FREQUENCY "LOSS-CONE" FLUTE INSTABILITIES INHERENT TO TWO-COMPONENT PLASMAS
L. D. Pearlstein, M. N. Rosenbluth, and David B. Chang 1965 *In its* Theoret. Studies of Space Plasmas [1966] p 45–58 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-6708)

It is shown that when a low temperature homogeneous plasma is added to a high temperature "loss-cone" limited homogeneous plasma in the presence of a uniform magnetic field, high frequency flute-type unstable oscillations occur. For a fractional density of hot plasma (Δ) on the order of unity the frequency and growth rates are on the order of the ion (electron) cyclotron harmonic frequency where the harmonic number (N) is determined by the ratio of plasma to cyclotron frequency for ions (electrons). If $\Delta N-1$ the instability occurs at the lower (upper) hybrid frequency. For $\Delta N<<1$ the instability only occurs when the ion (electron) cyclotron harmonic is equal to the lower (upper) hybrid frequency. Author

N66-28671*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
ON THE INTERACTION OF PLASMONS
David B. Chang *In its* Theoret. Studies of Space Plasmas [1966] p 71–100 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-7113)

The nonlinear interaction between plasma oscillation normal modes is studied in a hydrodynamic approximation. A modified quasilinear treatment is used, in which the normal modes are taken to affect each other through the slow nonlinear temporal and spatial changes they induce in the (equilibrium) background quantities. Plasmons, i.e., wave packets of plasma oscillations, are found in this approximation to have an interaction similar in form to the electromagnetic interaction. The plasmon interaction is describable in terms of scalar and vector potentials; quantities proportional to the slow changes induced in the background number and current densities play the roles of the scalar and vector potentials, with the thermal velocity playing the role of the speed of light. The source terms in the potential wave equations are quadratic in the normal mode density perturbation, which satisfies a Klein Gordon-like equation. The nonlinear interaction leads to an instability with a growth rate proportional to the square root of the ratio of the plasma oscillation energy to the background thermal energy. Author

N66-28807*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
A NEW APPROACH TO THE KINETIC THEORY OF PLASMAS

Charles J. Bartlett (Ph.D. Thesis) Jun. 1966 230 p refs (Grant NsG-496)
(NASA-CR-75777; CSR-T-66-1) CFSTI: HC $6.00/MF $1.25 CSCL 20I

A new approach to the kinetic theory of plasmas is presented. This approach is based upon the hierarchy of equations obtained from the Liouville equation by integration over position coordinates. The final reduction in description is accomplished by integrating the solution over the unwanted velocity coordinates. Three problems are studied. First, the initial reaction of the plasma to the presence of a small amplitude disturbance is shown to agree with the predictions of Landau. Second, a general kinetic (master) equation is derived for a spatially-homogeneous, stable plasma in the limit that the plasma parameter is small but not zero. This general equation, first derived by McCune, is shown explicitly to reduce, after integration over N-1 velocities, to the kinetic equation of Balescu and Lenard. Finally, the behavior of an unstable collisionless plasma is considered. Author

N66-28914# Kernforschungsanlage, Jeulich (West Germany). Institut fuer Plasmaphysik.
STABLE PLASMA CONFIGURATIONS IN THE MAGNETIC FIELD [STATIONAERE PLASMAKONFIGURATIONEN IN MAGNETFELD]
Karl Schindler Oct. 1962 24 p refs In GERMAN
(JUEL-78-PP) CFSTI: HC $1.00/MF $0.50

The non-relativistic Vlasov equation was utilized to find solutions for cylindrical stationary plasmas in axial fields where the magnetic field strength had only an axial direction and the electric field strength a radial direction. Distribution equations for the electrons and ions were formed under the assumption of quasi-neutrality, using the Boltzmann equation to express the electrical potential and the Maxwell equation to formulate the magnetic vector potential. Transl. by G.G.

N66-28820# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.
USE OF A LANGMUIR PROBE FOR ELECTRON TEMPERATURE DETERMINATION IN A LASER-INDUCED PLASMA
William F. Braerman Dec. 1965 49 p refs
(BRL-MR-1715; AD-631517) CFSTI: HC $2.00/MF $0.50

The possibility of using Langmuir probes for electron temperature determination in a laser-induced plasma has been demonstrated. Laser input energies less than 15 joules have been used and electron temperatures on the order of 0.5 ev have been inferred at various distances from the target. The beam was focused to approximately a 1 mm diameter spot. It is shown that the probe current of the start of the pulse follows the laser spiking. Author (TAB)

N66-28879# California Univ., Livermore. Lawrence Radiation Lab.
A PLASMA WITH RELATIVISTIC ELECTRONS IN A TRAP WITH MAGNETIC MIRRORS [PLAZMA S RELYATIVISTSKIMI ELEKTRONAMI V LOVUSHKE S MAGNITNYMI PROBKAMI]
G. I. Budker, V. I. Volosov, S. S. Moiseev, V. E. Pal'chikov, and F. A. Tsel'nik Sep. 1965 22 p refs Transl. into ENGLISH of Russian Paper CN-21/217 Presented at Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Culham, England, 6-10 Sep. 1965
(UCRL-TRANS-1261(L)) CFSTI: HC $1.00/MF $0.50

Various uses of relativistic electrons in connection with magnetic mirror plasmas are discussed. Plasma stability is discussed from the standpoint of injecting relativistic electrons. Separate discussions are presented on heating of the plasma ions, magnetic bremsstrahlung, and the problem of relativistic electron injection. NSA

N66-28981# Stanford Univ., Calif. Inst. for Plasma Research.
ABSOLUTE INSTABILITIES OF OBLIQUELY-PROPAGATING CYCLOTRON HARMONIC PLASMA WAVES
F. W. Crawford and J. A. Tataronis Jul. 1965 39 p refs
(Contract AT(04-3)-326)
(SU-IPR-20) CFSTI: HC $2.00/MF $0.50

Studies were made of micro-instabilities associated with the dispersion relation for cyclotron harmonic waves in a warm magnetoplasma. A thorough study is made of the instabilities occurring for propagation oblique to the magnetic field, and series of computed dispersion curves are presented indicating the various regions of stability and wave growth. Even more violent instabilities are predicted for this case, over a very wide range of wave-numbers, and with a much lower instability threshold value of (ω_p/ω_c) than for perpendicular propagation. The relevance of these instabilities to results from some fusion study plasmas and to noise generation in crossed-field electron devices is discussed. Author (NSA)

N66-29007# Los Alamos Scientific Lab., N. Mex.
STABILITY OF A BUMPY LINEAR, $\beta = 1$, θ-PINCH
Richard L. Morse 11 Mar. 1966 22 p refs
(Contract W-7405-ENG-36)
(LA-3442-MS) CFSTI: HC $1.00/MF $0.50

The stability of high β cylindrical plasma of variable radius, $r = a(z)$, is treated with the approximation that the plasma and field are separated by a thin, perfectly conducting surface. In the equilibrium condition $B_\theta = 0$ and the plasma is Maxwellian. For surface modes of the form $r = a(z) + \varepsilon_0(z) \cos m\theta\, e^{\lambda/\tau}$, the perturbed magnetic field pressure is obtained with the further assumption that $|a'|, |aa''| << 1$. The perturbed plasma pressure is taken from previous calculations based on the model in which particles travel in straight lines and bounce specularly at the plasma surface. The requirement of pressure balance at the perturbed surface leads to a normal mode equation for the surface which shows instabilities caused by regions of "bad curvature," i.e., $a'' < 0$. For $a(z) = a + \delta a \cos kz$ and $|\delta a/a| << 1$, analytic expressions for growth rates are obtained. The most unstable modes are those which have a long wavelength along the cylinder axis. Author (NSA)

N66-29042# Aktiebolaget Atomenergi, Stockholm (Sweden).
CHARACTERISTICS OF LINEAR MHD GENERATORS WITH ONE OR A FEW LOADS
E. A. Witalis Feb. 1966 16 p refs Presented at Magnetohydrodynamic Elec. Power Generation, 2nd Intern. Symp., Salzburg, Austria, Jul. 1966
(AE-214)

The theoretical performance of linear series segmented MHD generators with finite size electrodes and one or a few identifical external loads is investigated. The electrical characteristics are evaluated as functions of the segmentation degree, the Hall parameter and the relative position of short-circuited electrodes. Special consideration is given to the influence of staggering the electrodes, i.e., shifting the relative positions of short-circuited electrodes. General electrical terminal characteristics, i.e., the full current-voltage relation, can not be obtained by the exact analytical method, which is applicable only to so-called design load conditions or infinitely long

MHD channels. However, it is shown how the general properties can be explained qualitatively and calculated approximately by describing off-design modes of operation in terms of a fictitious "effective" number of external loads.
Author (NSA)

N66-29106# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
LOW-VOLTAGE DIFFUSE DISCHARGE IN ATMOSPHERIC-PRESSURE HELIUM WITH SMALL ADDITIONS OF POTASSIUM
H. I. Ellington Jul. 1965 25 p refs
(AERE-M-1597)

A description is given of the properties of a low-voltage, high-current electric discharge in atmospheric-pressure helium containing a small quantity of potassium vapor as seed. The results for helium are compared with those for argon. The dependence of the properties of the discharge on total current, temperature, and potassium pressure is discussed. The reasons for the difference between the helium and argon results are given, and these differences are shown to be consistent with the theory of non-equilibrium conductivity. As in the case of argon, a theoretical explanation of the variation of positive column field with current is given, and the existence of an optimum seed pressure demonstrated. The dependence of the break-down voltage of the gas on electrode spacing, temperature, and potassium pressure is discussed.
Author (NSA)

N66-29162# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
COUPLING OF WAVES IN A HOT INHOMOGENEOUS ANISOTROPIC ELECTRON PLASMA Scientific Report No. 2, Jun. 1–Nov. 30, 1965
K. E. Lonngren, A. Shoelund, and P. Weissglas 20 Jan. 1966 19 p refs
(Contract AF 61(052)-895)
(RADC-TR-66-187; AD-631844) CFSTI: HC $1.00/MF $0.50

The coupling of waves in a region of varying density in a hot anisotropic electron plasma is studied theoretically. The influence of the width of the inhomogeneous region and of the angle between the propagation vector and the static magnetic field are investigated. The latter parameter is shown to be very important.
Author (TAB)

N66-29163# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
EXPERIMENTS ON ION-ACOUSTIC WAVES Scientific Report No. 4, Jun. 1–Jan. 15, 1966
P. O. Nilsson 25 Jan. 1966 13 p refs
(Contract AF 61(052)-895)
(RADC-TR-66-189; AD-631846) CFSTI: HC $1.00/MF $0.50

Propagation of ion-acoustic waves was observed in the positive column of a low pressure mercury discharge. Both self-excited and externally excited waves were shown to exist in the frequency range 50–120 khz. The waves were approximately unattenuated. The experimental dispersion relation is compared with theory.
Author (TAB)

N66-29165# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
VARIATION OF ELECTRON DENSITY AND NEUTRAL GAS DENSITY ALONG A PLASMA COLUMN Scientific Report No. 1, Jun. 1–Aug. 31, 1965
Ake Nord 15 Jan. 1966 15 p refs
(Contract AF 61(052)-895)
(RADC-TR-66-186; AD-631843) CFSTI: HC $1.00/MF $0.50

The axial variation of the electron density and the neutral gas density along a mercury plasma column were measured. The electron density was determined from measurements of the shift of the resonance frequency of a cylindrical microwave cavity operating in the TM_{010}-mode. From measurement of the attenuation of mercury resonance line radiation at 2537Å the neutral gas density was determined. Both the electron and the neutral gas densities were found to increase towards the anode.
Author (TAB)

N66-29175# General Dynamics/Fort Worth, Tex.
MULTI-FLUID ANALYSIS OF WAVE PROPAGATION IN A MAGNETOPLASMA Final Report, 27 Jan.–31 Dec. 1965
23 Mar. 1966 135 p refs
(Contract AF 49(638)-1428)
(FZM-4609; AFOSR-66-0692; AD-631694) CFSTI: HC $4.00/MF $1.00

A theoretical investigation has been conducted to determine the propagation characteristics of small amplitude, hydromagnetic waves in a magnetoplasma-filled waveguide at signal frequencies approximately equal to or less than the ion-cyclotron frequency. An inviscid, quasi-one-fluid analysis was made which includes the effects of Hall field. A more complex analysis was made which incorporated the effects of unequal electron and ion temperatures, space charge, diffusion, and current inertia. The method of approach was then generalized to permit treatment of neutral particle dynamics. This include partial ionization of the plasma and the existence of a sheath of neutral particles at the walls of the waveguide. A numerical study was also conducted to establish the significance of multi-fluid effects on the phase velocity, attenuation, cutoff frequency (where pertinent), and wave patterns.
Author (TAB)

N66-29214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND THEORETICAL PERFORMANCE OF COAXIAL PLASMA GUNS
Charles J. Michels and Albert E. Johansen Washington, NASA, Jul. 1966 34 p refs
(NASA-TN-D-3469) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Experimentally determined calorimetric exhaust efficiencies and exhaust velocities are compared with predicted values from a snowplow model analysis. Four gun geometries (employing argon propellant) are examined analytically and experimentally over a range of initial masses and voltages. Noncrowbarred and crowbarred results are described. Experimentally stable operation of a gun has been limited to mass distributions for which a simplified analysis limits maximum efficiencies to about 40 percent. Experimentally measured efficiencies for optimum propellant distributions are approximately one-half those predicted from the simplified analysis (the maximum experimental efficiency was 22.2 percent). Experimental efficiencies agree somewhat better with peak efficiencies predicted by the complete theory. Experimental velocities agree approximately with both forms of the theory, but are generally somewhat lower.
Author

N66-29228# RCA Victor Co., Ltd., Montreal (Quebec). Research Labs.
LINEARLY POLARIZED WAVES IN PLASMAS IN THE REGION OF THE ELECTRON CYCLOTRON FREQUENCY Scientific Report No. 3

Morrel P. Bachynski and Brian W. Gibbs Jan. 1966 26 p refs
(Contract AF 19(628)-4071)
(RCA Res. Rept.-7-801-43; AFCRL-66-137; AD-632318)
CFSTI: HC $1.00/MF $0.50

Linearly polarized incident electromagnetic waves were propagated along the direction of a static magnetic field through a helium afterglow plasma in the frequency region of the electron cyclotron frequency. The experimental measurements illustrate clearly the behavior of the two transverse wave modes that the plasma can support. At high electron densities the right-hand circularly polarized component is completely attenuated and the variation of the transmitted is due entirely to the left-hand circularly polarized component. Alternately at low electron densities the plasma is transparent to the left-hand mode and the variation in transmitted is due to the righthand mode. Detailed comparisons of measurements of the phase and intensity of the components of the electric field transmitted through the plasma in the same orientation as the incident polarization and cross-polarized to the incident polarization show good agreement with theory.
Author (TAB)

N66-29229# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
NUMERICAL CALCULATIONS OF FIELDS AND DISPERSION CURVES FOR A HOT, INHOMOGENEOUS CYLINDRICAL PLASMA Scientific Report No. 5, 1 Jun. 1965-15 Jan. 1966
L. Sjogren 25 Jan. 1966 25 p ref
(Contract AF 61(052)-895)
(RADC-TR-66-304; AD-632541) CFSTI: HC $1.00/MF $0.50

A method for the numerical solution of the system of differential equations describing the electric field in a cylindrical plasma surrounded by a metal shield, has been developed. The plasma is hot, inhomogeneous and situated in a constant magnetic field. The method has been applied to a case with wave propagation and magnetic field both parallel to the axis of the cylinder. Numerical solutions for the inhomogeneous plasma have, as yet, been obtained only for test purposes, as the program construction has just been completed. A preliminary study of the plasma with constant electron density has been made for the mode which has axial symmetry.
Author (TAB)

N66-29255# Harry Diamond Labs., Washington, D. C.
AN EQUATION FOR PHASE VELOCITIES IN A PARTIALLY IONIZED GAS
H. D. Curchack and F. T. Harris Feb. 1966 25 p ref
(HDL-TR-1316; AD-632125) CFSTI: HC $1.10/MF $0.50

This report extends previous work on a fully ionized gas by including the effects of neutral particles. Proper manipulation of the equations yields a homogeneous linear differential equation for the vector conduction current density. By choosing the conduction current density of the form E(IW(T-Y/V)), the magnetic field in the X-Y plane, and by setting the determinant of the coefficients in the homogeneous scalar conduction current density equations equal to zero, an expression is obtained relating many phase velocities to the properties of the plasma. This report shows the mathematical derivation of the determinant.
Author (TAB)

N66-29280# Arizona Univ., Tucson. Engineering Experiment Station.
FIELD OF AN AXIALLY SLOTTED CIRCULAR CYLINDER CLAD WITH AN INHOMOGENEOUS DIELECTRIC Scientific Interim Report No. 3, Aug. 1965-Jan. 1966
George Tyras Feb. 1966 24 p refs
(Contract AF 19(628)-3834)
(AFCRL-66-203; AD-632140) CFSTI: HC $2.60/MF $0.50

The problem of an axial slot on a circular cylinder clad with a radially inhomogeneous plasma (dielectric) was considered recently by Rusch. Although his formulation is quite general inasmuch as it admits a realistic approximation to the plasma sheath inhomogeneities, the resulting solution is not well suited for computations of field patterns of large cylinders. In the present formulation the author considers the dielectric permittivity profile of the form $\epsilon(\rho)=(\rho/b)^{2p}$, $a \leq \rho \leq b$, where 'a' is the radius of the conducting cylinder, 'b' is the outer radius of the dielectric coating and 'p' is an arbitrary parameter. It follows that the assumed profile is capable of representing an inhomogeneous cold plasma when $p>0$ and a real dielectric when $p<0$. The apparent advantage of the present formulating is the fact that the wave equation can be solved in terms of known functions and the solution can be extended to large cylinders. Field expressions appropriate to small and large cylinders are found using standard methods of harmonic series representation, Watson transformation and saddle point integration. In the case of large cylinders coated with cold plasma, the radiation patterns are plotted for various combinations of the cylinder radius, thickness of the coating, and the inhomogeneity gradient.
Author (TAB)

N66-29297*# California Univ., Los Angeles. Dept. of Physics.
INTERACTION BETWEEN ION BEAMS AND PLASMAS
R. Rowberg, A. Y. Wong, and J. M. Sellen (TRW Systems, Redondo Beach) Apr. 1966 18 p refs
(Grant NGR-05-007-066)
(NASA-CR-75818; R-6) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Preliminary results are reported on the interaction between a low energy cesium ion beam (1 to 30 eV) and a thermal cesium plasma (0.25 eV), and an attempt was made to determine the stability limits for ion acoustic waves due to this interaction. Experimental apparatus includes an ion gun, which is shown in a schematic of the system. It was pointed out that the beam density studied decreased as the beam velocity increased. The maximum beam density achieved was 10^{10} particles per cc, and the background plasma density ranged from 10^{9}/cc to 10^{11}/cc. Oscillations were found to propagate in the azimuthal direction and in the direction of the electron density gradient drift. Both the fundamental and the first harmonic of this wave were observed. In addition, a second oscillation was observed propagating in the azimuthal direction with about the same frequency as the drift wave. The longitudinal mode was also studied, and no interaction between the wave and the beam was found.
R.U.

N66-29316# Polish Academy of Sciences, Warsaw.
ELECTRICAL PARAMETERS OF THE DC MHD GENERATOR WITH VARIOUS ELECTRICAL CONNECTIONS OF ELECTRODES [PARAMETRY ELEKTRYCZNE GENERATORA MAGNETOHYDRODYNAMICZNEGO PRZY ROZNYCH ELEKTRYCZNYCH POLACZENIACH ELEKTROD]
Analiza Jednowymiarona and Zdzislaw N. Celinski May 1965 177 p refs In POLISH; ENGLISH summary
(INR-654/XVIII/PP) CFSTI: HC $5.00/MF $1.00

Electrical parameters in the dc MHD generator with arbitrary connected electrodes were investigated. Constant gas dynamic parameters and constant generator cross section

were assumed. A vector diagram technique is developed to investigate the electrical parameters in the MHD generator. Electrical equivalent circuits were found and terminal values of electrical parameters (current, voltage, power, internal resistance) were determined. The numerical method of the two-dimensional analysis of the MHD generator with arbitrary electrode connections was developed. A correction factor λ was calculated, the use of which makes it possible to correct one-dimensional theory equations for two-dimensional effects. Author

N66-29317# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
MICROSCOPIC DESCRIPTION OF PLASMA AND NONLINEAR INCOHERENT LIGHT SCATTERING [MIKROSKOPISCHE PLASMABESCHREIBUNG UND NICHTLINEARE INKOHAERENTE LICHTSTREUUNG]
A. Salat Mar. 1966 92 p refs In GERMAN; ENGLISH summary
(IPP-6/49) CFSTI: HC $3.00/MF $0.75

The plasma density is given as a sum of delta-functions in 6-dimensional configuration space. From the division of the density into an ensemble average and fluctuations about it, and the equations of motion there results an exact system of equations for the quantities. The equations are expanded up to the first order in the plasma parameter and are suitable for calculating fluctuations and correlations in plasmas. The equivalence to a generalized dressed particle model is shown without explicit calculations. The relations between the distribution about a test particle is generalized to arbitrary initial correlations. For stable plasmas the influence of physically reasonable initial conditions on the two-particle correlations vanishes for large times. The equations derived are used to calculate the nonlinear incoherent scattered light produced by two electromagnetic waves on thermal fluctuations. The scattered light spectrum consists of linear combinations of the incident frequencies broadened by Doppler effects, generally according to thermal electron density fluctuations. When the difference frequency approaches the plasma frequency the intensity of the scattered light increases and the spectrum is given by the ion density fluctuations. Author

N66-29332*# Stanford Univ., Calif. Electron Devices Lab.
DC STATES OF PLASMA DIODES Quarterly Status Report No. 12, 1 Jan.–1 Apr. 1966
[1965] 18 p refs
(Grant NsG-299-63)
(NASA-CR-62729) CFSTI: HC $1.00/MF $0.50 CSCL 21I

Stationary potential distributions between parallel plane electrons and ion emitting surfaces are studied. A theory is outlined for calculating the dc characteristic of a cesium plasma diode to find out if a negative slope is obtained under certain critical conditions. The space charge equation is programmed for more convenient computation, using a second order difference operator. Equations are presented for the coexistence of surface phases and diffusion. The feedback of ions from the potential maximum in front of the emitter is investigated to determine whether it is a more effective means to redistribute the adsorbate between the surface phases. Expansion of a computer program for studying the randomization of electron energies in thermionic diodes is also discussed. This involved simulation of emission properties of a hot tungsten plate partially covered with cesium, and of electron-neutral and ion-neutral collision simulations by random processes. S.P.

N66-29349*# National Aeronautics and Space Administration, Washington, D. C.
ON THE INSTABILITY OF A NONUNIFORM RAREFIED PLASMA IN AN INTENSE MAGNETIC FIELD [O NEUSTOYCHIVOSTI NEODNORODNOY RAZREZHENNOY PLAZMY V SIL'NOM MAGNITNOM POLE]
L. I. Rudakov and R. Z. Sagdeyev Jul. 1961 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 138, no. 3, 1961 p 581–583
(NASA-TT-F-8044) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Experimental investigations on ohmic heating of a plasma by means of a current directed along an intense magnetic field show that instabilities develop within the plasma which cannot be explained within the framework of ideal magnetic hydrodynamics. This paper examines an instability mechanism whose appearance is not connected with the plasma's anisothermicity nor with a compulsory presence of a longitudinal electric current. R.N.A.

N66-29376*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF NONADIABATIC PARTICLE LOSSES IN AXISYMMETRIC AND MULTIPOLAR MAGNETIC FIELDS
J. Reece Roth 13 Sep. 1965 34 p refs Submitted for Publication
(NASA-TM-X-56894) CFSTI: HC $2.00/MF $0.50 CSCL 20H

This paper contains an investigation of the nonadiabatic behavior of a single nonrelativistic charged particle in two magnetic field geometries; an axisymmetric magnetic mirror, which was investigated by both analytical and experimental means, and a minimum-B configuration formed by the superposition of a multipolar (Ioffe) magnetic field on an axisymmetric magnetic mirror, which was studied only by analytical means. The nonlinear equations of motion for a charged particle in these magnetic field configurations were solved for 10^5 sets of initial conditions on a highspeed computer. A particle was considered to be nonadiabatic if its "adiabatic invariant" $M_4 \sim v_\perp^2/B$ varied by more than 5 percent during a single interaction with the magnetic mirror in question. By defining suitable dimensionless similarity parameters, it was found possible to summarize the computer results in a single analytical expression, which predicts the conditions under which nonadiabatic behavior will be observed as a function of the particle initial conditions. This similarity relation is a useful substitute for a closed-form solution to the nonlinear and nonholonomic mathematical problem and may be used as a basis for correlating experimental data. Author

N66-29395*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
TWO-STREAM INSTABILITY IN GRAVITATING PLASMAS WITH MAGNETIC FIELD AND ROTATION
S. P. Talwar Mar. 1965 25 p refs
(NASA-TM-X-55176; X-641-65-97) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The problem of instability in contrastreaming streams of plasma or self-gravitating gas clouds is investigated for general propagation direction, using moment equations. A uniform rotation is also included in view of its astrophysical importance. Conditions for instability (monotonic or growing wave) are derived. It is found that the classical Jeans' wavelength for fragmentation of interstellar medium is considerably diminished due to interstreaming speeds. For a non-gravitating plasma it is concluded that perturbations propagating normal to the interstreaming direction lead to a monotonic instability.

This instability, though characterized by a small growth rate, should be possible to observe in laboratory plasmas if dimensions are suitably chosen to eliminate the conventional electrostatic two-stream instability. Author

N66-29426*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOLUME AND SURFACE INSTABILITY IN SLIDING PLASMAS
S. P. Talwar Feb. 1965 33 p refs
(NASA-TM-X-55177; X-641-65-65) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The electrostatic instability arising due to a tangential discontinuity of velocity in two semi-infinite homogeneous regions of a cold and collisionless plasma subject to a uniform magnetic field is investigated using two fluid equations. A general dispersion relation is derived allowing for interstreaming of charged particles in each region in addition to a slippage of one region over the other. Special cases are then discussed and the criteria for stability, monotonic instability, and growing wave instability are derived. Author

N66-29435*# Stanford Univ., Calif. Inst. for Plasma Research.
COMPUTER EXPERIMENTS IN PLASMA PHYSICS
O. Buneman and D. A. Dunn Jan. 1965 61 p refs
(Grant NsG-299-63)
(NASA-CR-57710; SU-0254-2) CFSTI: HC $3.00/MF $0.75 CSCL 20I

The equations of motion of many interacting particles can be solved simultaneously using modern computers. Given the initial conditions, the subsequent behavior of all of the particles can be calculated and examined in graphs and motion pictures. The results of such computer experiments have led to new insights in many areas of plasma physics. Author

N66-29436*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
COLLECTIVE BREMSSTRAHLUNG EMISSION FROM PLASMAS CONTAINING ENERGETIC PARTICLE FLUXES
Derek A. Tidman and Thomas H. Dupree (MIT) Jan. 1965 52 p refs
(Grant NsG-220-62)
(NASA-CR-60390; BN-384) CFSTI: HC $3.00/MF $0.50 CSCL 20I

The bremsstrahlung emitted from thermal plasmas which co-exist with a flux of energetic (suprathermal) electrons is calculated. Under some circumstances the radiation emitted can be greatly increased compared to the emission from a Maxwellian plasma with no energetic particles present. The enhanced emission occurs at the fundamental and second harmonic of the electron plasma frequency. Author

N66-29453# Northrop Space Labs., Hawthorne, Calif.
EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS OF CROSSED-FIELD PLASMA ACCELERATORS. PART III: REPORT OF HIGH POWER ACCELERATOR TESTS AND CLASSIFIED RESULTS
S. T. Demetriades May 1963 97 p refs
(Contract AF 33(657)-8558)
(ASD-TDR-63-307; Pt. III; AD-348487) (Declassified)

Theoretical and experimental studies of continuous crossed-field accelerators have been extended. The results indicate that the electrical power dissipation in the electrode drop region is the major source of heat transfer to "cold" electrodes. Experimental heat transfer values were determined from calorimetric measurements on the water-cooled electrodes. Data obtained over a range of magnetic field strengths, accelerator power levels, and channel pressures are shown to fit a correlation of the form developed analytically. Measurements are reported for the performance of a continuous crossed-field accelerator as a function of magnetic field strength, accelerator power, applied current and electrode position. An analysis of the current density distribution in an accelerator was found to provide accurate estimates of the fraction of theoretical thrust obtainable from a crossed-field accelerator. Author

N66-29469*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SCALAR FORMULATION OF IDEAL CHARGED GAS FLOW
Lawrence A. Schmid Jun. 1965 36 p refs Submitted for Publication
(NASA-TM-X-56607; X-641-65-227) CFSTI: HC $2.00/MF $0.50 CSCL 20I

In the case of adiabatic flow of an ideal electron or ion gas in the presence of gravitational and electromagnetic fields, it is possible to derive a system of scalar equations of motion for the gas that provides an alternative to the Euler formulation. The new dynamical variables that replace the velocity are three scalars, one of which is a generalization of the flow potential and satisfies a general Hamilton–Jacobi equation. The other two are constants of motion that specify the intrinsic vorticity, which is that part of the total vorticity that is not produced by the external fields, but rather is simply a residue of the initial conditions of the gas. It is this intrinsic vorticity that satisfies the generalization of the simple vorticity conservation theorem. The same formalism can be adapted to the case of constant-temperature flow, and to the flow of an arbitrary barotropic fluid. Author

N66-29487# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
IMHOMOGENEOUS DEVELOPMENT OF A PLASMA THROUGH QUASI-LINEAR THEORY
H. Bloomberg Apr. 1966 43 p refs
(MPI-PAE/P1-25/66) CFSTI: HC $2.00/MF $0.50

A quasi-linear perturbation expansion is used to study the evolution of a localized disturbance introduced in a homogeneous plasma characterized by a distribution function having a small "bump" on its tail. For this problem first order theory of the Vlasov equation predicts the development of growing waves. The curtailment of this instability through a plateau development in v space is given through the second order corrections. During the curtailment process the distribution function develops weak time and space dependence. There is shown an energy transfer balance between the growing waves and the particles with bump velocity which are part of the "background" distribution function and those which are second order in the "disturbance" distribution. The plasma is affected by the localized disturbance throughout a much wider region. Comparison with earlier quasi-linear theory is made. Author

N66-29490# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
NEW FAST CAPACITOR BANKS FOR THETA-PINCH EXPERIMENTS AT THE INSTITUT FUER PLASMAPHYSIK IN GARCHING

K. H. Fertl, G. Herppich, A. Knobloch, and H. Schlageter Apr. 1966 24 p Presented at the 4th Symp. on Eng. Probl. in Thermonucl. Res., Rome, 23–27 May 1966
(IPP-4/26) CFSTI: HC $1.00/MF $0.50

Three lumped parameter capacitor banks of different stored energies will be described. The 400 kHz- and 100 kHz-banks are being mounted and will be connected to symmetrically double-fed linear coils; this series connection gives rise to a higher discharge frequency. Special features of the first two banks are the collector system, which at the 500 kJ-bank permits alternatively feeding of a toroidal experiment with minimum replacement of components, the use of impulse cable plug contacts and a peculiar coil arrangement for the bias field at the 10 kJ-bank. The 2.6 MJ-bank "Isar I" has now been in operation at 1.5 MJ (30 kV) more than one year without considerable technical difficulties. About 3000 discharges including those with partial energy have been made. Author

N66-29506*# Denver Research Inst., Colo.
ELECTROMAGNETIC WAVE CHARACTERISTICS OF A FULLY IONIZED GAS Final Report
Jack G. Hewitt, Jr. and Jack L. Boone Jun. 1966 51 p refs
(Grant NsG-518)
(NASA-CR-75919; DRI-2337) CFSTI: HC $3.00/MF $0.50 CSCL 20I

The equations for incident, reflected and transmitted waves are given for a magneto plasma slab of a thickness which is of the order of a wavelength of the incident signal. The transmitted power term is derived and compared, in the cold, collisionless approximation, to data taken from microwave interferometer measurements on a quiescent cesium magneto plasma. A theoretical development of the MHD energy and momentum equations is carried out in terms of the electromagnetic stress tensor to give expressions in terms of the field terms only. This coupled with the wave solution gives another way to attack the problem of plasma motion due to the forces of an incident EM field. Author

N66-29525*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Physics.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF TURBULENCE INSTABILITIES AT PLASMA-MAGNETIC FIELD INTERFACES Semiannual Report
Winston H. Bostick Apr. 1965 17 p refs
(Grant NsG-596)
(NASA-CR-75870; SIT-P163(7/65)) CFSTI: HC $1.00/MF $0.50 CSCL 20I

In studying turbulence from eddies in a plasma coaxial accelerator, image converter photographs were taken of its operation. The photographs and probe measurements showed that the main current carrying sheath is planar on the front and bullet-shaped on the rear, and that the luminosity in the rear is greater than at the front. Additional investigations were made into the intrusion of plasma into a model magnetosphere. Two experiments are described in which photographic evidence of flute like fine scale structure near the polar region was observed. These plasma eddies were interpreted to be the outgrowth of Rayleigh–Taylor instability flutes which occur when the plasma is decelerated by the magnetic field of the dipole. H.S.W.

N66-29531# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
THE INTERNAL POTENTIAL FALL IN MHD GENERATORS [DER INNERE POTENTIALABFALL IN MHD-GENERATOREN]
M. Salvat Apr. 1966 18 p In GERMAN; ENGLISH summary
(IPP-3/38) CFSTI: HC $1.00/MF $0.50

The finite length of the electrodes in MHD generators perturbs the potential distribution corresponding to an ideal case (i.e., to infinitely segmented electrodes). Hence the potential drop between the electrodes and thus the internal resistance of the generator increase. It is shown by means of simple physical arguments that the change of the potential drop and the corresponding increase of the internal resistance are expressible in the form

$$\frac{\Delta\zeta^*}{\Delta\zeta^*} = \frac{Ri}{R} = \frac{1}{A+\beta D}$$

where $\Delta\zeta^*$ and R are the potential drop and the internal resistance, respectively; the subscript "i" denotes the "ideal" case. $\beta = \omega T$ is the Hall coefficient, A and D are two parameters which, as will be shown here, are defined by the geometry and the relative position of the electrodes. Author

N66-29538# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
GEOMETRIC HIGH-FREQUENCY MODELS AND POTENTIAL ANALOGS FOR THE DETERMINATION OF CURRENT AND FIELD DISTRIBUTIONS
A. Knobloch, J. Mantel, G. Roos, H. Schlageter, and F. Werner May 1966 71 p
(IPP-4/30) CFSTI: HC $3.00/MF $0.75

For the choice of electrical and other data for fast capacitor banks used for experiments in plasma physics, the project engineer uses observations and measurements made on appropriate models. The following report describes the models of various collector and load configurations and discusses the measurements made on them. Author

N66-29615# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
RADIAL AND AXIAL DISTRIBUTION OF THE ELECTRON DENSITY OF A THETA PINCH AS A FUNCTION OF TIME [RADIALE UND AXIALE ABHAENGIGKEIT DER ELEKTRONENDICHTE ZU VERSCHIEDENEN ZEITPUNKTEN EINER THETA-PINCH ENTLADUNG]
H. Glaser Jun. 1965 55 p refs In GERMAN; ENGLISH summary
(IPP-1/38)

The spatial distribution of the electron density in the main-discharge of a 26–K Joule θ-pinch was investigated as a function of time. The electron density was determined spectroscopically from the continuum radiation. Eight light pipes yielded the radial distribution of the plasma radiation. The radial distribution of the magnetic field was determined by probe measurements. Streak photographs yield additional information on the radial, axial, and temporal behavior of the plasma column. Measurements were carried out with a parallel trapped magnetic field (0.8 KG, p_{H_2} = 0.15 Torr) and an antiparallel trapped magnetic field (−2.3 KG, p_{H_2} = 10 Torr). For interpreting the experimental results obtained from the main discharge, knowledge of the characteristic data of the preionization is required. Therefore, the electron density, temperature, and magnetic field distribution in the applied preionization close to the medium plane of the coil was measured at the beginning of the main discharge. Author (NSA)

N66-29622# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE APPLICATION OF NOISE TECHNIQUE TO THE DIAGNOSTICS OF MAGNETO-HYDRODYNAMICS

W. Ciechanowicz Apr. 1965 20 p
(INR-626/IX/R)

Two methods of applying the noise technique to the diagnostics of MHD flow are discussed. The determination of the electric conductivity of the ionized gas from the velocity of the gas and the magnetic induction is considered as an example. NSA

N66-29734*# Texas Univ., Austin. Plasma Dynamics Research Lab.
EVALUATION OF FARADAY-SHIELDED STIX COILS FOR ION CYCLOTRON RESONANCE HEATING OF A PLASMA Technical Report No. 3
N. B. Dodge, Magne Kristiansen, and Arwin A. Dougal 30 Apr. 1966 49 p refs
(Grant NsG-353)
(NASA-CR-76019) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The spatial waveform of the azimuthal electric field (E_θ) of the Stix coil is investigated. Methods are developed to improve the E_θ waveform by making it more nearly sinusoidal. Varying the spacing between individual coil turns in the coil section, along with the use of a "squirrel-cage" type Faraday shield are found to give a more nearly sinusoidal waveform. The effect of a number of Faraday shields on the E_θ waveform is also presented and it is found that certain types of shields, notably the single-slit copper cylinder shield, introduce distortions into the accelerating (E_θ) field. The efficiency of these shields in reducing the longitudinal electric field (E_z) is reported. Several are found to be efficient E_z shields, except for a Faraday shield placed outside the Stix coil. The effect of Faraday shields on the equivalent circuit parameters of the Stix coil is also determined and the variation of these parameters among the various shields is tabulated. Author

N66-29741*# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
DYNAMICS OF A PINCH DISCHARGE DRIVEN BY A HIGH CURRENT PULSE-FORMING NETWORK
Neville A. Black (Ph.D. Thesis) May 1966 163 p refs *Its* Rept.-778
(Grant NsG-306-63)
(NASA-CR-76014) CFSTI: HC $5.00/MF $1.00 CSCL 20I

A large-radius, linear pinch discharge is driven by a high current pulse-forming network, consisting of a simple ladder configuration with capacitance added at various points along the distributed inductance afforded by two parallel-plate conductors. The dynamical behavior of discharges is well represented by a snowplow model. The dynamical efficiency of the discharge as a gas accelerator is found to be favored by conditions that provide for maximum mass accumulation early in the acceleration process. Under certain conditions a precursor current pulse is observed to separate from the main current sheet, and to propagate ahead with twice snowplow velocity. Author

N66-29939# Giannini Scientific Corp., Santa Ana, Calif.
TOROIDAL PLASMA CONTAINMENT WITH ROTATING MAGNETIC FIELD Final Report
D. E. Brown and H. G. Loos Apr. 1966 50 p refs
(Contract AF 49(638)-1539)
(FR-046-1539; AFOSR-66-0778; AD-632379) CFSTI: HC $2.00/MF $0.50

Experimental investigations were conducted on a toroidal plasma with alternating pinch and θ-pinch magnetic fields as well as with a θ-pinch and with a screw pinch. For the alternating pinch, the resultant magnetic vector is rotating, so that there are no periodic zeros in the containing magnetic pressure, and containment times for high-plasmas may possibly be extended beyond one half cycle. Also, for field rotation frequencies much smaller than the electron collision frequency, shear occurs in the magnetic field through the skin of the plasma, thereby improving the plasma stability. If the current sheet thickness measured from the oscillograms is taken as skin depth, Suydam's necessary condition for stability of a linear pinch with a rotating magnetic field is not satisfied in our experiments. The fanning effect occurring right after the plasma compression in the second half cycle in toroidal θ-pinches is quenched by the rotating field, but plasma conditions for the θ-pinch and for the alternating pinch are not comparable on account of the inhibiting effect of the pinch magnetic field on the ionization caused by the θ-pinch field. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-28419*# Kansas Univ., Lawrence.
INVESTIGATION OF ELECTROCALORIC EFFECTS IN FERROELECTRIC SUBSTANCES Status Report No. 4, Sep. 1, 1965–Feb. 28, 1966
Gordon G. Wiseman et al [1966] 35 p refs
(Grant NsG-575)
(NASA-CR-75700) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Electrocaloric measurements of triglycine sulfate from 273° to 334°K at fields up to 306 kilovolts per meter yielded values of 322.6°K (49.45°C) for the Curie temperature and 4280°K for the Curie constant C. Both, electrocaloric and dielectric observations showed that the ferroelectric transition in TGS is of second order. Relaxation effects prevented an accurate determination of the second Devonshire coefficient. Values for the pyroelectric coefficient were determined from the electrocaloric measurements for the entire temperature range. Above the Curie temperature range, the pyroelectric coefficient was controlled by bias field change, and below the Curie range it was independent of the field. G.G.

N66-28479*# Old Dominion Coll., Norfolk, Va. Dept. of Physics.
DEFECT ANNEALING IN IRRADIATED SEMICONDUCTORS Progress Report No. 4, Oct. 1, 1965–Mar. 31, 1966
W. Maurice Pritchard 1 Apr. 1966 23 p refs
(Grant NsG-602)
(NASA-CR-75722) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Empirical values of isothermal model parameters were calculated, and activation energies for vacancy motion were determined from these model parameters in connection with a study on defect annealing in irradiated semiconductors. A computer program was written to determine the best empirical fit of the annealing model to two sets of experimental isothermal annealing data for antimony doped n-type germanium; and both theoretical and experimental curves are included. M.W.R.

N66-28510# Naval Research Lab., Washington, D. C. Electron Tubes Branch.
ELECTRON BEAM SCANNING TECHNIQUE FOR MEASURING SURFACE WORK FUNCTION VARIATIONS
G. A. Haas and R. E. Thomas *In its* Rept. of NRL Progr. Dec. 1965 p 7-12 (See N66-28508 16-23) CFSTI: $1.25

A technique has been developed in which a scanning beam of electrons is used to analyze the work function variations of surfaces. Characteristics such as adsorption, migration, effusion, and other problems of surface kinetics can be monitored on a continuously presented television display of the surface work function topography. Distributions in work function can be determined by the use of a 400-channel analyzer which is incorporated in the equipment. It also is possible to determine the nature of the patch fields encountered in front of the low work function patches. An analysis of these patch field plots makes possible the determination of the average low work function patch diameter. Author

N66-28515# Naval Research Lab., Washington, D. C. Radiometry Branch.
LASER ACTION IN TRIPLY ACTIVATED GLASS
H. W. Gandy, R. J. Ginther, and J. F. Weller *In its* Rept. of NRL Progr. Apr. 1966 p 1-9 refs (See N66-28514 16-23) CFSTI: $1.25

Pulsed optical excitation experiments performed at liquid nitrogen temperature upon confocal etalons fabricated from barium crown glass triply activated with UO_2^{2+}, Nd^{3+}, and Yb^{3+} having indicated that either Nd^{3+} or Yb^{3+} or both ions can be excited to exhibit laser oscillations. This controllable selection of the lasing species was demonstrated in both the free running and self Q switched modes of optical resonator operation. A physical description of the processes involved in these experiments is given followed by a theoretical description of the excited state population kinetics of doubly activated luminescent systems. Author

N66-28600# Brown Univ., Providence, R. I.
STUDY OF SURFACE PROPERTIES OF ATOMICALLY-CLEAN METALS AND SEMICONDUCTORS Progress Report, 1 Jul.-31 Dec. 1965
H. E. Farnsworth, B. D. Campbell, and M. Onchi [1966] 51 p refs
(Contract DA-28-043-AMC-00299(E))
(PR-8; AD-630863) CFSTI: HC $4.60/MF $0.50

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N66-28601# Brown Univ., Providence, R. I.
STUDY OF CdS SURFACES BY LEED
In its Study of Surface Properties of Atomically-Clean Metals and Semicond. [1966] 16 p refs (See N66-28600 16-26) CFSTI: HC $4.60/MF $0.50

A description of a new LEED apparatus and vacuum system is given. Some of the previous experiments were repeated with essentially the same results. Studies were made of the effect of oxygen adsorption on the photovoltage and surface potential of the (0001) SPECULAR surface activated by a hot filament and by an intense light, and of subsequent desorption by heating and ion bombardment. The results indicate that the high sticking coefficient gas produced at the hot filament in the presence of oxygen is probably atomic oxygen. Photodesorption of adsorbed oxygen at room and elevated temperatures was attempted but was not observed. There were preliminary indications that the photovoltage could be decreased to a small value by mild heating even when the surface was covered with adsorbed oxygen, and there was a high negative surface barrier. Carbon monoxide exposures were made in the dark (13000 Torr-min) and under an intense light (570 Torr-min) but no adsorption was observed. Author

N66-28685# Princeton Univ., N. J. Solid State Electronics Lab.
TRANSIENT CURRENT MEASUREMENTS IN PHTHALOCYANINE, AN ORGANIC SEMICONDUCTOR Technical Report No. 8
C. R. Westgate and G. Warfield Jan. 1966 66 p refs
(Contract DA-31-124-ARO(D)-191; Grant NSF-GP-579; ARPA Order 462)
(AROD-4742-4; AD-478736)

Using a transient space charge limited current technique and a crystal counter technique, the drift mobilities in the c^* direction of metal free and lead phthalocyanine single crystals were determined. Mobilities in the range 0.05-0.1 cm^2/V-sec. in metal free phthalocyanine and 0.6-4.0 cm^2/V-sec. in lead phthalocyanine were observed for both electrons and holes. Definite values of the mobilities and the temperature dependencies of the mobilities could not be found from the cusp in the transient space charge limited current technique because of the characteristics of the crystals that were available. The mobilities were calculated from the initial currents injected. Traps with a density of $10^{14}/cm^3$ and an activation energy of 0.36 eV were found in both lead and metal free phthalocyanine crystals. These trap characteristics were determined by thermally stimulated trap emptying measurements. Bandwidths narrower than those found in anthracene were calculated. In the c^* direction, a bandwidth of kT/10 was found for electrons. It is proposed that the electron-phonon interactions must be included in a more fundamental way than the usual perturbation approach. Author

N66-28728# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.
SEMICONDUCTOR JUNCTION PROPERTIES AS INFLUENCED BY CRYSTALLOGRAPHIC IMPERFECTIONS Scientific Report No. 1, 15 Feb. 1965-15 Feb. 1966
Guenter H. Schwuttke Mar. 1966 155 p refs
(Contract AF 19(628)-5059)
(TR-22.234; AFCRL-66-192; AD-631612) CFSTI: HC $5.00/MF $1.00

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N66-28729# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

A NEW X-RAY DIFFRACTION MICROSCOPY TECHNIQUE FOR THE STUDY OF IMPERFECTIONS IN SEMICONDUCTOR CRYSTALS

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 42 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

High intensity X-ray diffraction microscopy by extinction contrast was used to obtain crystal topographs of high resolution, as well as large area topographs of entire crystal slices containing appreciable amounts of reversible and/or frozen-in strains. In this method, crystal, screen, and photo plate were aligned parallel to each other under all diffraction conditions, and the line focus of a standard X-ray scanning source was kept perpendicular to the plane of incident and the reflected beam. Various large area topographs of silicon wafers were obtained showing their dislocations and other impurities. It was concluded that the described X-ray technique can be used to correlate crystal imperfection and device reliability. G.G.

N66-28730# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

PRECIPITATION EFFECTS IN DIFFUSED TRANSISTOR STRUCTURES

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 17 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

The conditions under which excess gold collects in phosphorus-diffused layers (n+) on silicon wafers were studied by large-area X-ray topography of the planar diffused regions before and after gold diffusion. Also examined were diode storage times and reverse characteristics of the diffused structures and its effects upon diode behavior. It was found that the diffraction contrast after phosphorus diffusion was localized at certain points and caused by the presence of gold precipitates in cluster formation. Planar boron and arsenic diffused structures did not show excess diffraction intensity. Comparison of diode storage times with total gold concentrations showed that diodes of high phosphorus concentration had only a small amount of gold substituted in their lattice sites; all other diodes had most of the gold in substitutional sites. G.G.

N66-28732# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

DISTRIBUTION OF BORON-INDUCED DEFECTS IN SHALLOW DIFFUSED SURFACE LAYERS OF SILICON

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 16 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

Chemical sectioning and X-ray diffraction microscopy were used to measure boron induced impurity and defect concentrations in silicon wafer surface layers as a function of depth. Boron diffusion profiles showed a network of lattice defects parallel to the main face and ending in the vicinity of the junction plane. A layer of high elastic strain followed and reached beyond the junction into the bulk material. G.G.

N66-28733# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

MECHANISM BEHIND EMITTER DIP EFFECT

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 8 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

The nature of emitter dip effects (EDE) in high frequency n-p-n silicon transistors was studied by X-ray diffraction microscopy. Topographic observation of a (111) silicon slice containing base diffusion only, and of the same slice after subsequent phosphorus diffusion, showed that the observed second phases were localized within the phosphorus-diffused emitter layer. It was assumed that the dark spots in the X-ray topograph of the emitter layer were precipitated SiP complexes. Thus, the EDC was explained as the result of excess neutral vacancies that partly diffused toward the base collector junction where they enhanced the diffusion constant of the base impurities. G.G.

N66-28734# International Business Machines Corp., Hopewell Junction, N. Y. Components Div.

CRYSTAL STRUCTURE BREAKDOWN IN SILICON THROUGH LOCALIZED DIFFUSIONS

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 8 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

Silicon wafers of high perfection underwent substrate preparation, oxidation, opening of diffusion windows, and diffusion to study the crystal structure breakdown by diffusion-induced dislocations. Comparison of photomicrographs after boron diffusion with recorded topographs from crystal slices after phosphorus diffusion derived the following information: (1) window edges coincided with the boundary between diffused and undiffused silicon, thus indicating elastic strain; (2) diffraction contrasts inside the diffused area were attributed to dislocation networks; (3) unusual dislocation arrays were observed along the position edges of the oxide mask; and (4) long dislocation lines between the diffused islands indicated elastic strains in the silicon wafer due to localized diffusion. G.G.

N66-28735# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

X-RAY ANALYSIS OF DIFFUSION-INDUCED DEFECTS IN GALLIUM ARSENIDE

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 27 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

Diffusion induced defects in gallium arsenide wafers cut in the [111] and [001] orientation from horizontally boat-grown crystals were analyzed by X-ray diffraction microscopy and their fault vectors were determined. Zinc diffusion into gallium arsenide produced the following defects: A Lomer dislocation $\{(a/2)[110]\}$ and a Lomer–Cotrell dislocation $\{(a/6)[112], (a/6)[11\bar{2}], (A/6)[110]\}$. Both dislocations were sessile and had their axes in $\langle 110 \rangle$ directions. The development of Lomer–Cottrell type dislocations was caused by the formation of a highly doped shallow surface layer on $ZnAs_2$ followed by lattice strain. The stress generated locally through these clusters was then relieved by the formation of the dislocations. Thus, Lomer–Cottrell type dislocations represent an effective means of stress relief. G.G.

N66-28736# International Business Machines Corp., Hopewell Junction, N. Y. Components Dept.

DISLOCATION REACTIONS IN SILICON WEB-DENDRITE CRYSTALS

In its Semicond. Junction Properties as Influenced by Crystallographic Imperfections Mar. 1966 15 p refs (See N66-28728 16-26) CFSTI: HC $5.00/MF $1.00

Dislocation sources of in web-dendrite crystals of silicon were studied and characterized by X-ray diffraction microscopy using a scanning oscillator technique. The majority of the dislocations resulted from entrapment of liquid in the dendrite-filled region of the structure. High dislocation densities were found at twin planes when the latter were present in the web. Complex dislocation configurations were revealed by etching and are shown in several illustrations. It was concluded that the presence of twin planes parallel to the length of the web greatly increased the occurrence of Lomer type interactions. G.G.

N66-28740# United Kingdom Atomic Energy Authority, Harwell (England).
ELASTIC DIFFUSE SCATTERING OF NEUTRONS BY DILUTE FERROMAGNETIC ALLOYS
G. G. Low *In* India. Dept. of Atomic Energy Lectures on Solid and Liquid State Phys. 1965 p 1–41 refs (See N66-28739 16-23) CFSTI: HC $6.00/MF $1.50

Ferromagnetic alloy systems based on either nickel, iron, or palladium, with impurity concentrations of 1 to 2 percent, were measured for their magnetic moment change that was induced by elastic diffusion scattering of neutrons. Different types of behavior for different alloying atoms were observed depending whether the disturbance in the electron-to-atom ratio was positive or negative. Nickel–chromium and nickel–vanadium alloys showed a rapid loss in magnetic moment with increasing impurity content. Saturation magnetism levels increased with the addition of iron atoms; this phenomenon was attributed to an electron shift from the high density states in the d-band with subsequent creation of holes. Measurements of the palladium–iron system established the magnetic moment value for an iron atom in the alloy as about 2.8; scattering patterns changed with different impurity concentrations. Magnetic moment changes in iron alloys depended on whether the impurity atom was to the right of iron in the periodic table, to the left, or under the iron. It was assumed that this characteristic was related to the positions at which the Fermi level intersected the d-band in the matrices. G.G.

N66-28741# Edinburgh Univ. (Scotland). Dept. of Natural Philosophy.
DYNAMICS OF CRYSTAL LATTICES
W. Cochran *In* India. Dept. of Atomic Energy Lectures on Solid and Liquid State Phys. 1965 p 43–101 refs (See N66-28739 16-23) CFSTI: HC $6.00/MF $1.50

Lattice dynamics are studied by using a shell model to make heat calculations, find Raman spectra, develop matrix elements coming from short range forces as well as from coulomb interaction, etc. Also reported are measurements of ionic crystal lattice vibrations by neutron inelastic scattering and X-ray diffusion scattering techniques on $SrTiO_3$, PbTe, and several alkali halide crystals. G.G.

N66-28758# Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION Annual Progress Report, Period Ending 31 Dec. 1965
Apr. 1966 82 p refs
(Contract W-7405-ENG-26)
(ORNL-3935) CFSTI: HC $3.00/MF $0.75

Brief summaries of 78 investigations being carried out at ORNL in the field of solid state physics are presented. NSA

N66-28794*# Illinois Univ., Urbana. Coordinated Science Lab.
ANGULAR DISTRIBUTION OF AUGER ELECTRONS
In its Theoret. and Exptl. Studies of the Underlying Processes and Tech. of Low Pressure Mass. Apr. 1966 p 97–100 refs (See N66-28786 16-14) CFSTI: HC $5.00/MF $1.00

The apparatus being designed to study the angular distribution of Auger electrons is described. The apparatus is intended to measure Auger neutralization, electron diffraction, and secondary electron emission. Low energy ions or electrons impinge on a single crystal tungsten target. The scattered or ejected electrons will pass through a slot in the shield and be collected by a Faraday cage collector. Two grids attached to the collector will make possible the direct measurement of the energy distribution of the electrons by modulating the electron beam and using an ac detection technique. The apparatus is shown schematically. It is reported that the vacuum chamber, target assembly, collector assembly, and ion gun are completed. N.E.N.

N66-28809# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
KOSSEL DIFFRACTION PATTERNS OF A URANIUM SINGLE CRYSTAL
E. F. Sturcken *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-Ray Diffraction in the Atomic Energy Field Oct. 1965 p 5–11 refs Work performed at Rutgers Mater. Res. Lab. (See N66-28808 16-17) (Contract AT(07-2)-1)

Pseudo-Kossel diffraction conics of a uranium single crystal were obtained by the back-reflection divergent-beam method. The conics are sharp because of the high absorption coefficient of uranium, and are large in number because of the low crystal symmetry of uranium. The pseudo-Kossel technique permits resolution of planes of the same form (111, $\bar{1}11$, $1\bar{1}1$, etc.) yields high precision (1 part in 10^6) and requires short exposure times (3 min). It should be a good technique for studying changes in lattice parameters and anisotropic lattice distortions that result from radiation damage in uranium. Author

N66-28810# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TEXTURE STUDIES IN MONOCLINIC PLUTONIUM
F. E. Bowman *In* Hanford Atomic Prod. Operation Papers and Proc. of the Meeting on Appl. of X-ray Diffraction in the Atomic Energy Field Oct. 1965 p 12–14 (See N66-28808 16-17)

An investigation of the texturing introduced in monoclinic plutonium by various treatments is undertaken. An underlying objective is the production and identification of pseudo-single crystals. The fundamental crystallographic characteristics of the monoclinic plutonium are presented, as well as a discussion of the unique problems in their investigation. Despite an inherent lack of ductility, this material has been successfully deformed by rolling. The existence of a resulting texture has been established, and the derivation of the details of this texture is discussed. Other treatments, not necessarily involving plastic deformation, also have been found to produce a textured structure. These treatments, together with the type of texturing produced, are presented and discussed. Author (NSA)

N66-28828# Library of Congress, Washington, D. C. Aerospace Technology Div.
GROWTH OF SILICON CARBIDE SINGLE CRYSTALS
John G. Kourilo *In its* Foreign Sci. Bull., Vol. 2, No. 5 May 1966 p 7–15 refs (See N66-28824 16-16)

Communist World research efforts on the growth of α- and β-SiC single crystals is reviewed. The Soviet and East European (East German) research mainly consisted in developing the known Western vapor phase techniques—the Lely technique for α-SiC crystals and pyrolysis of organosilicon compounds for β-SiC crystals. Progress was noted in development of the Lely technique. Using the improved Lely technique, α-SiC single crystals were grown up to 8 mm in size, and up to 10^3 ohm.cm resistivity. The Soviet production of α-SiC single crystals for use in high-temperature semiconductor devices is still based on commercial crystals from abrasive material plants. Some progress was noted in the development of new organosilicon systems for growing β-SiC crystals by pyrolytic reduction. Communist Chinese research is progressing toward developing a vapor phase technique for epitaxial growth of α-SiC thin films. Author

N66-28975# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
SOLID STATE INVESTIGATIONS UTILIZING ELECTRON-BOMBARDMENT PHENOMENA
Martin A. Pomerantz 29 Oct. 1965 77 p refs
(Contract AT(30-1)-2730)
(TID-22342) CFSTI: HC $3.00/MF $0.75

Measurements are reported of the effects of alpha-particle irradiation on the electric conductivity of diamond; the effects of electron irradiation on the electric conductivity of diamond, RbBr, and NaBr; electron-beam-induced desorption of Th atoms from W and Re surfaces; electron diffraction by Al and W surfaces; and gas adsorption onto W surfaces. NSA

N66-29062# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires
SUPERCONDUCTING THIN FILMS. APPLICATION TO THE CONSTRUCTION OF FAST STORAGE DEVICES [LES COUCHES MINCES SUPRACONDUCTRICES. APPLICATION A LA REALISATION DE MEMOIRES RAPIDES]
Michel Hesse Dec. 1965 30 p refs In FRENCH
(CEA-BIB-65)

Superconductivity and its main properties are first presented. Then, application to fast digital storage devices is described by reviewing various realizations of binary cells and memory planes. Author (NSA)

N66-29128# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
THE GROWTH OF SINGLE CRYSTALS Interim Scientific Report
Charles S. Sahagian Jan. 1966 65 p refs *Its* Phys. Sci. Res. Paper No. 186
(AFCRL-66-33; AD-631073) CFSTI: HC $3.00/MF $0.75

Single crystals of over 100 different electronically active materials have been synthesized using a variety of methods, including growth by flame-fusion, flux, melt, gel diffusion, low-temperature solution, vapor, as well as synthesis by ultra-high-pressure techniques. These crystals, including a large number of doped specimens, emphasize oxides, garnets, silicates, ferrites, fluorides, as well as a large variety of other electromagnetic materials. Charts are presented giving summary data on single crystals grown, percentage and kind of dopants, growth methods and apparatus, crystal dimensions and other physical characteristics, primary research interest or use, crystal system, class, space group, and pertinent references. Several of the growth methods and recent Laboratory accomplishments are described. Author (TAB)

N66-29143# Franklin Inst., Philadelphia, Pa. Chemistry Div.
DIFFUSION IN ORGANIC CRYSTALS Semiannual Technical Report, 1 Oct. 1965–31 Mar. 1966
[1966] 44 p refs
(Contract DA-31-124-ARO(D)-142; ARPA Order 462)
(B2130-T-9; AROD-4168-9; AD-631698) CFSTI: HC $4.00/MF $0.50

Studies on the diffusion of phenanthrene and fluorene in anthracene crystals showed that the general order of magnitude of diffusivity is comparable to self-diffusion in the case of phenanthrene and three to six times slower in the case of fluorene. Anisotropy can be observed for impurity diffusion. The diffusion rate perpendicular to the ac plane is generally two to three times faster than that perpendicular to the ab plane. Evidence for sub-grain boundary diffusion in addition to a slower lattice diffusion process was obtained in the case of phenanthrene and self-diffusion in melt-grown anthracene crystals. Melt-grown anthracene crystals were evaluated by carrier trapping lifetime studies. In general the longest lifetimes are obtained in crystals where care has been taken to exclude the orientation of anthracene crystals grown from the melt. The seed crystal technique appears to be the most successful method judging by the results obtained so far. Author (TAB)

N66-29144# Battelle Memorial Inst., Columbus, Ohio.
STUDY OF SEMICONDUCTOR FAST-NEUTRON DOSIMETER FOR RANGE 0-50,000 RADS Final Summary Report
Gordon Kramer, W. H. Closser, and O. J. Mengali Edgewood Arsenal, Md., Nucl. Defense Lab., Apr. 1966 107 p refs
(Contracts DA-18-108-405-CML-1031; DA-18-035-AMC-298 (A))
(NDL-TR-55; AD-631742) CFSTI: HC $4.00/MF $0.75

Results of a study of a semiconductor neutron dosimeter for the range 0 to 50,000 rads are presented. The dosimeter is a wide-base, conductivity-modulated, silicon p-n junction whose forward resistance increases upon exposure to neutrons, because of a decrease in excess carrier lifetime. The relationship between bulk properties of silicon, various processing steps, base width, and forward-current level on dosimeter performance was studied. The results of this study have led to development of an improved device for the required application. Advances in the dosimeter-fabrication process have led to increases in device uniformity. The need for adequate process control to prevent material contamination is emphasized. Lifetime degradation in the completed dosimeter and consequently higher response threshold has been attributed directly to the thermal-diffusion cycle, and a reduction in the temperature and time in this step is suggested to improve the sensitivity at lower neutron flux. Present dosimeter response is accurate to plus or minus 25 percent at 50 rads (tissue) and improves rapidly at higher doses to plus or minus 2 percent at 50,000 rads (tissue). Long-term annealing effects at room temperature are shown to be negligible for dosimeter application. Author (TAB)

N66-29161# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
MICROWAVE EMISSION FROM N-TYPE InSb FOR VERY LOW ELECTRIC FIELDS Scientific Report No. 3, Jun. 1, 1965–Jan. 15, 1966
Toshimitsu Musha, Frank Lindvall, and Jarl Hagglund 20 Jan. 1966 16 p refs
(Contract AF 61(052)-895)
(RADC-TR-66-188; AD-631845) CFSTI: HC $1.00/MF $0.50

A new type of microwave radiation (at 2–4 kmc) was observed from N-type InSb bars at 77°K, which were subject to low electric field and high magnetic field simultaneously. The

threshold electric and magnetic fields for onset of the microwave emission are, respectively, 3 v/cm and 4 kgauss. The emission of microwave radiation is associated with the nature of the contacts between the specimen and the electrodes. The radiation temperature ranges from 1000°K (noise level) to 300,000° K. Author (TAB)

N66-29169# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
THE FORMATION OF A MAGNETIC PINCH IN InSb AND THE POSSIBILITY OF POPULATION INVERSION IN THE PINCH
Helmut Schmidt Feb. 1966 41 p refs
(DI-82-0502; AD-631711) CFSTI: HC $2.00/MF $0.50

A sufficiently strong current supported by an electron-hole plasma in InSb pinches. As the electron-hole gas is compressed by the current's magnetic field, the plasma temperature increases. The strong electron-phonon coupling, however, keeps the plasma temperature below the characteristic temperature of the optical phonons as long as the lattice remains cold. This early period of the pinch, which includes the initial contraction and some 0.0000001 sec thereafter, is discussed. The collapse of the pinch may be halted by an increase of the plasma pressure caused by the exclusion principle or by the occurrence of impact ionization in the pinch's radial Hall field. An estimate of the particle density in the pinch shows that the conditions for population inversion may be satisfied, hence laser action due to stimulated electron-hole recombination might occur. This effect should influence the development of the pinch decisively. Author (TAB)

N66-29196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFORMATION THEORY AND THE THERMODYNAMICS OF MASERS
R. S. Ingarden 15 Mar. 1966 57 p refs Transl. into ENGLISH from Postepy Fiz. (Warsaw), v. 15, no. 3, 1964 p 287–322
(FTD-TT-65-899/1+2+3+4; AD-631767) CFSTI: HC $3.00/MF $0.50

Contents: Maxwell's 'demon'; Szilard's solution; The concept of information according to Shannon; an axiomatic definition of information; the homogeneous case; the variational principle in generalized thermodynamics; Application in mathematical statistics; The thermodynamics of masers. ('Maser' is used here in the generic 'Molecular amplification by stimulated emission of radiation' sense, not 'Microwave amplification . . . '). TAB

N66-29240# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
CYCLOTRON RESONANCE PUMPING OF GAS LASERS Second Quarterly Progress Report, 1 Sep.–30 Nov. 1965
S. Ahmed and T. Faith May 1966 31 p refs
(Contract DA-28-043-AMC-01376(E))
(Rept.-2; AD-632100) CFSTI: HC $2.00/MF $0.50

Experiments employing combined microwave electron-cyclotron resonance with dc pumping as well as experiments with dc pumping only were performed on argon lasers. Effort was directed towards clearly defining the effects of these pumping combinations on discharge behavior and laser operation. Results of these experiments show that in low-wall-loss magnetically confined dc discharges, the gas pressure is greatly reduced by ion-drift pumping towards the cathode, and laser action takes place at considerably lower pressure than had hither-to been supposed. Microwave cyclotron-resonance pumping was seen to have a significant effect in increasing laser output. This increase in output occurred at high initial gas pressures, and is dependent on the magnetic field being at the resonance value. The laser tested was 40 centimeters long and 8 millimeters in diameter. It was fitted into a tunable microwave cavity within a magnetic solenoid. Measurements were made with both pulse and continuous operation. Author (TAB)

N66-29246# Boston Univ., Mass. Dept. of Physics.
THEORETICAL RESEARCH ON LASER MODELS Final Report, 1 Feb. 1963–31 Mar. 1966
Charles R. Willis 28 Feb. 1966 15 p refs
(Contract AF 19(628)-2460)
(AFCRL-66-166; AD-632109) CFSTI: HC $1.60/MF $0.50

A theory is developed for the description and understanding of laser behavior from a fundamental microscopic point of view. The model consists of N two-level systems interacting with a radiation field. The problems of collective motion, coherence, dissipation and inhomogeneous broadening are treated. This report consists mainly of the abstracts of six papers dealing with these subjects that have or will appear in scientific journals. Author (TAB)

N66-29267# Louvain Univ. (Belgium). Chemistry–Physics Lab.
THERMOELECTRIC POWER OF POLYCRYSTALLINE BISMUTH. PHONON DRAG SIZE EFFECT Final Scientific Report, 1 Dec. 1964–31 Dec. 1965
Jean-Paul Issi (Ph.D. Thesis) Dec. 1965 149 p refs
(Contract AF 61(052)-776)
(RADC-TR-66-176; AD-632557) CFSTI: HC $4.00/MF $1.00

It was found that the thermoelectric power of polycrystalline bismuth increases with decreasing thickness at room temperature. Parallel galvanomagnetic and resistivity measurements indicate that the mean free paths of the charge carriers remain unchanged in the range of thickness investigated. Applying Herring's simplified formula, combined with the law of emf's in parallel extended to three band conduction, it was found that a phonon-drag mechanism could explain the observed increase in TEP and the order of magnitude of the effect. The expected variation of the diffusion thermoelectric power with temperature in the range 80°–300°K was also computed, using the correct band structure and the temperature dependence of the density of free carriers. Besides, it was found that at 80°K, the magnetoresistance is not the same for thin foils, whether the magnetic field is perpendicular or parallel to the surface of the foil. Some interesting features are noted about the low-field galvanomagnetic coefficients. Author (TAB)

N66-29274# Emmanuel Coll., Boston, Mass. Oriental Science Library.
THE EFFECT OF HEAT TREATMENT ON THE FERROMAGNETIC RESONANCE OF LUTETIUM IRON GARNET AND MANGANESE FERRITE SINGLE CRYSTALS
Guo-Dong Li and Shang-Shu Tan Bedford, Mass., AFCRL, Mar. 1966 20 p refs Transl. into English from Wu Li Hsueh Pao (Peking), v. 20, no. 3, 1964 p 261–269
(Contract AF 19(628)-5073)
(EMM-65-39; AD-632408) CFSTI: HC $1.00/MF $0.50

In this paper, the effects of different heat treatments on the ferromagnetic resonance of lutetium ion garnet ($Lu_3Fe_5O_{12}$) and manganese ferrite ($MnFe_2O_4$) single crystals are investigated. The two heat treatments applied are, respectively, 700°C in air for one hour and 700°C in oxygen for ten hours. It is found that these treatments have no significant effect on the values of K_1/M_s and the g-factors, except that the anisotropy of the resonance line width ΔH decreases appreciably. Although the effect on ΔH of $Lu_3Fe_5O_{12}$ is small, the ΔH value of $MnFe_2O_4$ increases several times after each treatment. The cause for the variation of ΔH with heat treatment is discussed. X-ray diffraction patterns show that a small quantity of α-Fe_2O_3 precipitates in the manganese ferrite specimen after the latter is subjected to heat treatment. Author (TAB)

N66-29299*# Rice Univ. Houston, Tex.
RESEARCH ON THE PHYSICS OF SOLID MATERIALS Semiannual Status Report No. 14, 1 Nov. 1965-30 Apr. 1966
Franz R. Brotzen [1966] 35 p refs
(Grant NsG-6-59)
(NASA-CR-75814) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Abstracted data and program objectives are presented for three areas of research in the physics of solid materials: solid-state physics, covering magnetic and electric aspects of materials research; physical metallurgy, concerning metallic materials; and chemistry of solids including chemical reactions and thermodynamics involving solid substances. The solid-state research includes such topics as: spin-lattice interaction in paramagnetic crystals, polarization of stimulated emission of lasers, crystal optics of Mossbauer gamma rays, and radiant energy conversion. Some of the studies in physical metallurgy are: microcreep in b.c.c. metals, electrical resistivity of deformed molybdenum single crystals, electron microscope facility and thin-film research, and energies and entropies of solute atoms in dilute solid solution. Some of the chemistry of solids topics are: free energy of vacancy formation in solids, modified cell cluster theory, crystal structure of complex molecules, and radiation effects on metallic films and solid surfaces. L.E.W.

N66-29537# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
HOMOGENEITY INVESTIGATIONS ON SUPERCONDUCTING WIRES AND CABLES
P. Krueger and B. Oswald Apr. 1966 23 p refs
(IPP-4/31) CFSTI: HC $1.00/MF $0.50

Two procedures are described which enable a control of the homogeneity of the copper plating and the magnetization of the superconducting cross section along great lengths of superconducting wires and cables. With the first method, irregularities of the copper plating, such as different thickness, holes, or separation from the core, can be conceived quantitatively. With the second method, one can investigate the homogeneity of superconductors according to their magnetic characteristics. The conclusions which can be drawn from magnetization on the I_c-H_c-characteristics are discussed. Author

N66-29675# Philco Corp., Blue Bell, Pa. Applied Research Lab.
IMPURITY DOPED PHOTOCONDUCTORS Final Report, 1 May-31 Dec. 1965
R. B. Emmons and C. J. Repper [1965] 25 p refs
(Contract Nonr-4848(00))
(AD-632006) CFSTI: HC $1.00/MF $0.50

A model for the optical cross section of deep centers, which is superior to the hydrogenic model used for shallow centers, has been developed. Ga-doped Si appears to be a sensitive extrinsic photoconductor that can be more heavily doped than available Ge photoconductors. The characteristics of the particular Ga-doped Si examined are $N_a=1.2\times10^{16}$ cm^{-3}, $N_D=2\times10^{14}$ cm^{-3}, $E_A=0.071$ ev, Blip temperature=40°K, $D^*=6\times10^8$ cm (cps)$^{1/2}$ watt^{-1}, and $\tau=10^{-9}$ second at 40°K. These results appear to justify examination of Si doped closer to the Ga solubility limit (4×10^{19} cm^{-3}). Author (TAB)

N66-29691# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
AN INVESTIGATION OF ENERGY BAND STRUCTURE AND ELECTRONIC PROPERTIES OF LEAD SULFIDE AND LEAD SELENIDE
Sohrab Rabii (Ph.D. Thesis) 15 Jan. 1966 122 p refs Materials Theory Group Tech. Rept.-3; Energy Conversion and Semiconductor Lab. Tech. Rept.-10
(Contracts DA-31-124-ARO(D)-92; Nonr-1841(51))
(AD-631958) CFSTI: HC $4.00/MF $0.75

The Augmented Plane Wave Method of energy band calculation was used to calculate the non-relativistic band structure of lead sulfide and lead selenide. Spin-orbit interaction and mass-velocity and Darwin corrections were then applied as perturbation to these results to obtain the so-called relativistic band structure of these materials. A perturbation was carried out on the conduction and valence band edges, at point L on the surface of the Brillouin zone, to determine the nature of the constant energy surfaces and the effective masses and g-factors for the conduction and valence bands. The non-parabolic character of the band edge has been studied. The effect of the strain on the electronic properties of these materials has been studied through the calculation of their deformation potential constants. A comparison is made between the calculated results for the lead salt family with the experimental data, and various deductions are made regarding their properties. Author (TAB)

N66-29749*# Delaware Univ., Newark. Dept. of Physics.
INTRINSIC DEFECTS IN CdS Technical Report No. 9
Charles Alvah Kennedy (M.S. Thesis) Jun. 1966 74 p refs
(Grant NsG-573)
(NASA-CR-76029) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Thermal defects, occurring in the temperature range between room temperature and 350°C, were "frozen-in" in cadmium sulfide single crystal platelets in ultra-high vacuo and the effects of the resulting disorder upon the spectral distribution of photoconductivity in the visible range and upon conductivity glow curves were studied. Parallel shifts toward higher conductivity with increasing heat treatment temperatures in both the spectral response curves and the glow curves are interpreted in terms of dissociation of a defect associate, composed of at least three point defects, which acts as a recombination center. Glow curves simultaneously show growth of peaks at approximately 200°K and 440°K. These peaks, it is felt, are due to the products of the dissociation. Both of these peaks are believed to be associated with cadmium vacancies—the former a V_{cd} and the latter a cluster corresponding to an S_n molecule. Author

N66-29766# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF SURFACE CONTOURING AS APPLIED TO SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jan.-Jun. 1965

Jul. 1965 36 p refs
(Contract AT(30-1)-3246)
(NYO-3246-5) CFSTI: HC $3.00/MF $0.50

The application of geometrical surface field control (termed "surface contouring") to semiconductor p–n junctions of use in radiation detection and spectroscopy was investigated. Efforts during this period have dwelled on the junctions themselves with particular emphasis on study of the window or energy defect at the particle entrance face. This would seem to be of importance in realizing the potential for very low energy particle detection. Other experimentation was in the areas of attempts to arrive at the inherent speed or pulse risetime of the structures and measurements of uniformity of amplification laterally across the junction. Additional effort went into the development of a stable, low resistance base (n-type) junction contact. In this regard, a gold-antimony alloy contact applied by the thermal compression method was found to work well. NSA

N66-29816# Mithras, Inc., Cambridge, Mass.
RESONANT HARMONIC GENERATION AND NON-LINEAR OPTICS Technical Status Report No. 2 (Final), 1 Oct. 1964–30 Sep. 1965
Charles S. Naiman, Jack Schwartz, and Jacques Ducuing [1965] 35 p refs
(Contract AF 49(638)-1464)
(MC-63-96-R2; AFOSR-66-0701; AD-631676) CFSTI: HC $3.00/MF $0.50

Enhancement of the coefficient, X (2), of optical second harmonic generation by resonant absorption is discussed. In particular the conditions under which the resulting increase in X (2) overcomes any losses due to the linear absorptions so introduced are developed. Trivalent rare earth dopants in crystalline hosts of suitable symmetry, among other feasible materials, are examples of materials shown capable of efficient harmonic generation. Experimental techniques are developed for use in measuring and testing the relevant material properties, among them the use of stimulated Raman effect methods for shifting the frequencies of available laser sources. The theory of harmonic generation in absorbing materials is discussed plus the variation in measurement techniques required in experimental studies of these materials. Author (TAB)

N66-29821# New York Univ., N. Y. Dept. of Physics.
STUDY OF THE MECHANISM AND PROPERTIES OF THE PHOTOVOLTAIC AND PHOTOCONDUCTIVE EFFECTS IN ORGANIC SUBSTANCES Final Report, 1 Nov. 1963–31 Oct. 1964
Hartmut P. Kallmann Mar. 1965 24 p refs
(Contract AF 19(628)-2446)
(AFCRL-65-240; AD-621138) CFSTI: HC $1.00/MF $0.50

Research results in the following areas are reported: Larger than band gap photovoltages in anthracene, germanium layers, and evaporated zinc sulfide layers; and photovoltages due to inhomogeneous absorption of light and to chemical effects in organic solutions (E.G., alpha-methyl naphthalene, benzene, hemimellitine, mesitylene) and in cadmium sulfide single crystals. TAB

N66-29835# Delaware Univ., Newark. Dept. of Physics.
LAYERLIKE FIELD INHOMOGENEITIES IN HOMOGENEOUS SEMICONDUCTORS IN THE RANGE OF "NEGATIVE DIFFERENTIAL CONDUCTIVITY"
K. W. Boer [1965] 40 p refs
(Contracts Nonr-4336(00); DA-31-124-ARO(D))
(AD-614909) CFSTI: HC $2.00/MF $0.50

Characteristic layerlike field inhomogeneities are shown to occur in homogeneous semiconductors if the decrease in conductivity is stronger than linear with increasing field, and are discussed under a general aspect in a model using Poisson- and transport-equations and the fact that the neutral density of electrons and/or the mobility decreases with increasing field strength. The method of characteristics is used for discussion and permits an analysis of the experimental observations easily. Further experimental results about layerlike field inhomogeneities in CdS concerning domain-width and field strengths, influence of optical excitation and quenching, and net charging of CdS crystals are given and show good agreement with the proposed theory. Author (TAB)

N66-29844# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
OPTICAL AND MAGNETO-OPTICAL MEASUREMENTS ON MAGNETIC RARE EARTH-COBALT ALLOY FILMS
Alex M. Stoffel and Karl J. Strnat Mar. 1966 41 p refs
(AFML-TR-65-445; AD-632608) CFSTI: HC $2.00/MF $0.50

The results of an investigation of the Kerr magneto-optic effect and the complex refractive index for pure cobalt and for four ferromagnetic rare earth-cobalt alloys of the composition RCo_5 are reported. Magnetic data of all films are also given. The thin film samples were prepared by vapor deposition in ultrahigh vacuum and measured in situ. The effect of annealing and atmospheric corrosion on the optical and magneto-optical properties was investigated. The index of refraction, n, was found to decrease considerably after short exposure to air, while the Kerr effect increased. The rare earth alloys show an optical and magneto-optical behavior similar to that of cobalt. Dispersion curves of n, k, θ_m, ϵ_m, Q_e, and q for wavelengths of 400 to 616 $m\mu$ are presented. Author (TAB)

N66-29905# Naval Radiological Defense Lab., San Francisco, Calif.
THE NONPROPARTIONAL RESPONSE OF A NaI(Tl) CRYSTAL TO DIFFRACTED X-RAYS
Thomas H. Jones 24 Feb. 1966 42 p refs
(USNRDL-TR-985; AD-631709) CFSTI: HC $3.00/MF $0.50

Measurements have been made of the scintillation efficiency of a NaI (T) crystal for diffracted X rays in the energy range from 24.7 to 46.5 keV in 1 keV increments. The maximum deviation from linearity occurred in the region from 33 to 35 keV. The nonproportional response of NaI (T) to electrons in the regions from 0.051 to 45.426 keV was then derived using a model of the energetic electron array produced in the crystal by the incident diffracted X-rays. Author (TAB)

N66-29906*# Atomics International, Canoga Park, Calif.
INVESTIGATION OF SUPERCURRENT INSTABILITIES IN TYPE II SUPERCONDUCTORS First Quarterly Progress Report
13 May 1966 21 p
(Contract NAS8-20552)
(NASA-CR-76060; AI-66-87) CFSTI: HC $1.00/MF $0.50
CSCL 20L

Ti–Nb samples were annealed 3 hours at 800°C, rapidly cooled to retain the beta phase, and reannealed at from 400° to 550°C to initiate transformation. Light photomicrographs of samples before and after the transformation anneal are shown. After 24 hours at 450°C, particles appear in the matrix and on grain boundaries. A sample annealed 2 hours at 500°C contains what is probably equilibrium alpha phase that has nucleated at grain boundaries. Electron microscope samples

were prepared from bulk samples by chemically or electrolytically thinning. Electron diffraction patterns are obtained for each photomicrograph to orient the foil and to solve the crystal structure of the precipitating phase. Precipitation in samples annealed at 400°, 450°, and 500°C gave particle densities of 10^{15} cm^{-3} for the first two temperature and 10^{14} cm^{-3} for the latter; average particle sizes were 500, 1500, and 2000 Å, respectively. Alloy samples were rolled to a 2:1 reduction after rapidly cooling from an 800°C anneal. The deformation caused the metastable beta phase to transform. The untransformed volume probably was not severely deformed. Subsequent annealing at 350° to 500°C produces further transformation. Light microscopy offers little insight into the complexities of this process. R.N.A.

N66-29951# New York Univ., N. Y.
INVESTIGATION INTO SELECTED PROBLEMS IN SOLID STATE PHYSICS Final Report, 1 Feb. 1963–1 Feb. 1966
J. L. Birman [1966] 10 p refs
(Grant DA-ARO(D)-31-124-G424)
(AROD-4054-14; AD-632552) CFSTI: HC $1.00/MF $0.50

Brief summaries are given of results of work in the following areas of solid state theory: Space Group Theory (See AD-619351); Application of Space Group Theory to Analysis of Infrared and Raman Processes in Crystals; Dynamical Theory of Infrared Absorption in Crystals; Dynamical Theory of Raman Effect in Crystals; Theory of Luminescent Centers in II-VI Compounds; Theory of Properties of Wurtzite Crystals (Phonon Dispersion, and Optical Properties of CdS) (see AD-629702); Theory of Phonon–Oppenheimer (Adiabatic) Approximation for Periodic Potentials; Configurational Instability (Jahn–Teller Effects). Author (TAB)

N66-29957# Ecole Normale Superieure, Paris (France).
OPTICAL SPECTROSCOPY OF SEMICONDUCTOR MATERIALS Annual Summary Report No. 2, 1 Jan.–31 Dec. 1965
M. Balkanski [1965] 8 p ref
(Contract AF 61(052)-789)
(AFCRL-66-221; AD-632145) CFSTI: HC $1.10/MF $0.50

Problems concerning lattice dynamics, absorption on free carriers and galvanomagnetic properties of highly doped and degenerate silicon are studied. Author (TAB)

N66-29963# Army Electronics Lab., Fort Monmouth, N. J.
ELECTRICAL PROPERTIES OF ELECTRON IRRADIATED GERMANIUM
Milton Harmatz and Peter Hollander Mar. 1966 22 p refs
(ECOM-2682; AD-632539) CFSTI: HC $1.00/MF $0.50

Measurements of the electrical properties of arsenic-doped germanium irradiated at 300°K with electrons and annealed at high temperatures are reported. Bombardments with 1.5 MeV electrons on 1.2 ohm-cm n-type material caused the conductivity to decrease initially to a minimum value after being irradiated with 7×10^{15} electrons/cm^2, and then to increase slowly with additional radiation. The negative Hall coefficient increased at first, and then exhibited a reduction when the fluence increased beyond 7×10^{15} electrons/cm^2. Hall effect measurements indicated that the material converted to p-type following a fluence of 1.1×10^{16} electrons/cm^2. Conversion was observed after the conductivity passed the minimum value. A small decrease of two percent in the Hall mobility following a fluence of 7×10^{14} electrons/cm^2 was produced. The data indicated that the carrier removal rate was .6 carriers/electron cm. In irradiated 16 ohm-cm n-type material which had been converted to p-type, reversion occurred rather quickly at an annealing temperature of 312°K. The annealing rate was slower following the maximum resistivity and negative Hall coefficient values. The sample was not restored to its pre-irradiated condition following the highest annealing temperature conducted. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-28678# Naval Ordnance Lab., White Oak, Md. Advanced Chemistry Div.
DEVELOPMENT OF THE CONTINUOUS WIRE METHOD Progress Report No. 2
Donna Price, Irving Jaffe, and John P. Toscano 17 Mar. 1966 35 p refs
(NOLTR-66-21; AD-482223)

This report covers the second period of development work on use of the continuous wire method to follow shock-to-detonation transitions. It describes a successful method of producing satisfactory cast charges containing properly aligned wires. Methods of data reduction which have been developed are reported; they include as much automation as possible and have greatly reduced the data handling time. Detonation velocity measurements by the wire method on charges 15 cm long are accurate to within 0.5% (six shots). Values for cast Comp B and DINA are 7.97 and 7.72 mm/μsec, respectively. The first objective of future work is improvement of synchronization in the electronic circuits. Author

N66-28737# Naval Ordnance Test Station, China Lake, Calif.
THEORY OF IGNITION OF SOLID PROPELLANTS
E. W. Price, H. H. Bradley, Jr., G. L. Dehority, and M. M. Ibiricu Mar. 1966 109 p refs
(NOTS-TP-3954; NAVWEPS-8987; AD-480226)

Surface ignition of solid propellants has been represented by several analytical models, each involving obvious compromises with regard to scope of applicability. These models are distinguishable primarily in terms of site of the exothermic reaction governing ignition. Early research with nitrocellulose led to development of a theory involving chemical heat generation in the condensed phase. Two subsequent theoretical models were developed to explain ignition of the solid fuel ingredient of a composite propellant in an oxidizing atmosphere, and these two models were then extended on a heuristic basis to encompass a composite propellant in an inert atmosphere in which the oxidizing gas was produced by decomposition of the solid oxidizer. These two models are distinguished by whether the oxidation occurs at the surface or in the gas film above the surface. This report reviews the solid, heterogeneous, and gas-phase ignition theories and reviews the nature and implications of the assumptions involved. It is concluded that, while possessing certain drastic simplifications in common, the various quantitative models differ so conspicuously in their assumptions regarding external initiating stimulus as to make quantitative comparisons or tests of validity impossible. Author (TAB)

N66-29193# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RAMJET TECHNOLOGY. CHAPTER 6: FUELS
W. E. Wilson, Jr. and W. G. Berl Jul. 1965 64 p refs
(Contract NOw-62-0604-c)
(TG-610-6; AD-631653) CFSTI: HC $3.00/MF $0.75

This chapter deals primarily with the criteria for selecting a satisfactory fuel. It discusses methods of calculating flame temperatures and specific impulse parameters, and outlines prospects for obtaining fuels with improved performance. TAB

N66-29454*# Bureau of Mines, Pittsburgh, Pa. Explosives Research Center.
HYDROGEN SAFETY Progress Report No. 7, 1 Jul.–30 Sep. 1965
R. A. Van Meter, A. Strasser, E. L. Litchfield, and J. Grumer Oct. 1965 21 p refs
(Contract SNC-21)
(NASA-CR-75387) CFSTI: HC $1.00/MF $0.50 CSCL 21I

Performance characteristics of two console-type, diffusion-and-convection-sampling hydrogen gas detectors were evaluated in experiments simulating likely operating conditions. The detector head of one console unit was found to be position sensitive. Figures illustrate the reproducibility of response to known concentrations of hydrogen, and the diminution of meter readings induced by subjecting the analyzer head to −24°C temperature. The filament temperatures of the second detector were determined photoelectrically. The rate of meter response to a 5.3 percent hydrogen concentration, and the results obtained when the second detector was checked for reproducibility of response to various known concentrations of hydrogen in air are depicted graphically. It was found that the instrument no longer functioned as it did prior to the exposure to 100 percent hydrogen. When the second detector was exposed to mixtures of hydrogen in air which had been bubbled through water, there was a decrease in meter reading below the zero setting. Jet plume experiments using helium rather than hydrogen were continued, and combustion characteristics of heterogeneous mixtures of hydrogen and air are summarized. R.Li.

N66-29689# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE PERFORMANCE OF VARIOUS MIXTURES OF HYDROGEN AND METHANE
Clyde William McLaughlin (M.S. Thesis) Mar. 1966 89 p refs
(GAM/ME/66A-6; AD-632387) CFSTI: HC $3.00/MF $0.75

The primary purpose of this study was to evaluate the performance of various mixtures of hydrogen and methane as a fuel with oxygen as an oxidizer. A computer program was used to provide the theoretical results at a chamber pressure of 60 psia and mixture ratios from 1.5 to 5.0. The fraction of methane in the fuel was varied from 0 to 1.0. Experimental results were obtained by using a small reverse flow rocket engine and three separate propellant feed systems with a mixing chamber to combine the hydrogen and methane prior to the gases entering the fuel manifold of the rocket. A nonlinear degradation of characteristic exhaust velocity was found as the fraction of methane in the fuel was increased. The degradation with all methane as the fuel was 77% of the pure hydrogen–oxygen performance. Experimentally, the combustion efficiency was found to decrease with an increasing percentage of methane in the fuel. Author (TAB)

N66-29818# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ADDITIVE FOR SUPPRESSING VANADIUM CORROSION OF FUELS
R. A. Lipshtsyn and A. S. Avetisyan 20 Sep. 1965 6 p Transl. into ENGLISH from Soviet Patent No. 162269 (Appl. No. 849707/23-4, 29 Jul. 1963) 1 p
(FTD-TT-65-506/1+4; TT-65-64042; AD-621778) CFSTI: HC $1.00/MF $0.50

The object of the invention is an additive for suppressing vanadium corrosion of fuels on the basis of green oil. For the purpose of improving the additive's properties tetraethoxysilane or the bottoms in the production of tetraethoxysilane is added to the green oil. Author (TAB)

N66-29958# Naval Ordnance Test Station, China Lake, Calif.
ALUMINUM PARTICLE COMBUSTION Progress Report, 1 Apr. 1964–30 Jun. 1965
Apr. 1966 120 p refs
(NOTS-TP-3916; TPR-415; AD-632606) CFSTI: HC $4.00/MF $1.00

The report includes (1) a short literature survey on the combustion of aluminum particles, (2) a discussion of spherical combustion models and their limitations, and (3) a summary of experimental studies at NOTS on the combustion of aluminum in air, carbon monoxide–oxygen, hydrogen–oxygen, and cyanogen–oxygen. Combustion in an inverted gas burner was followed by high-speed cinephotography; quenched residues were examined photomicrographically. Combustion initiated in air by xenon flash was investigated by streak photography and photomicroscopy of quenched residues. Results indicate that aluminum droplets burn by concurrent oxidation at the surface and in a detached reaction zone a distance from the surface. The oxide resulting from surface reaction collects into caps on the droplet surface. The product in the detached zone is Al_2O_3 smoke. Large oxide droplets and bubbles are associated with shedding of surface oxide present as a consequence of preignition conditions of subsequent surface oxidation. Spinning and jetting are consequences of the presence of a surface oxide. Catastrophic fragmentation appears to be related to the accumulation of surface oxide. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-28542*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
ANALYTICAL AND EXPERIMENTAL VIBRATION ANALYSIS OF THE TURBINE BUCKETS FOR THE M-1 LIQUID OXYGEN TURBOPUMP
L. K. Severud and T. Chinn [1965] 59 p refs
(Contract NAS3-2555)
(NASA-CR-54830; AGC-8800-74) CFSTI: HC $3.00/MF $0.50 CSCL 21H

The shrouded turbine bucket natural frequencies and associated resonant shaft speeds for the M-1 Liquid Oxygen Turbopump are presented in this report. Both analytical and

experimental analysis are discussed and correlated. Using the experimental findings, the operating range of 3500 rpm to 4000 rpm was investigated for resonant points. Analysis showed that the first-stage blade package could develop a secondary resonant problem as a result of its second mode of tangential vibration being excited by the second harmonic of the upstream 43 nozzle blade stimulus. No resonant problems are expected for the second-stage blade packages. Author

N66-28545*# Itek Corp., Palo Alto, Calif. Vidya Div.
ANALYTICAL AND EXPERIMENTAL STUDY OF ABLATION MATERIAL FOR ROCKET-ENGINE APPLICATION Final Report
Roald A. Rindal, D. T. Flood, and R. M. Kendall 15 May 1966 287 p refs
(Contract NAS7-218)
(NASA-CR-54757; Vidya-201) CFSTI: HC $6.00/MF $1.50 CSCL 21H

A combined theoretical-experimental program has been conducted for the purpose of developing techniques for rating the performance of ablative materials in liquid-propellant rocket engines. The theoretical studies resulted in the development of a computer program for characterizing the response of charring ablation materials in high temperature, chemically reactive environments of arbitrary chemical composition. The experimental investigations resulted in the successful modification of an arc-plasma generator so that it would operate with the necessary gases and at the conditions requisite to achieving simulation of ablative-material response in two liquid-propellant environments, namely, O_2–H_2 and N_2O_4–N_2H_4/UDMH. Author

N66-28921# ARO, Inc., Arnold Air Force Station, Tenn.
STUDY OF THE ENERGY ADDITION PROCESS IN A D-C ARC-JET
R. J. Bryson and J. P. Froehlich Arnold Eng. Develop. Center, Apr. 1966 25 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-65-268; AD-631591) CFSTI: HC $2.00/MF $0.50

The thrust produced by a d-c arc-jet plasma generator operating with argon was measured and used to determine the division of the energy added to the gas between that which produced excitation and ionization and that which served to increase the translational energy of the gas. Energy division predicted by the Rayleigh heat addition theory was compared with the experimental determination and was found to be in fair agreement (15 to 30 percent). The plasma generator was operated at electrical power inputs ranging from 1.9 to 3.8 kw. Energy losses to the electrodes amounted to about 30 percent, so that about 70 percent of the total electrical energy input was actually added to the gas. The amounts of energy added to the gas ranged from 220 to 440 Btu/lb-m at an argon flow rate of 0.00527 lb-m/sec. On the average, only about 40 percent of this energy addition was utilized to increase the total translational energy of the gas, and the remainder served to produce electronic excitation and ionization. Author (TAB)

N66-29070*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PREDICTION OF PROPELLANT TANK PRESSURIZATION REQUIREMENTS BY DIMENSIONAL ANALYSIS
J. F. Thompson and M. E. Nein Washington, NASA, Jun. 1966 21 p refs
(NASA-TN-D-3451) CFSTI: HC $1.00/MF $0.50 CSCL 21H

A general equation, based on a dimensional analysis of a number of pressurization tests, was derived in order to predict pressurant gas mass requirements for cylindrical and spheroidal liquid oxygen and hydrogen propellant tanks. The equation is accurate to within ±10%. It is noted that the method is primarily intended for preliminary design and optimization studies in which the use of large computers becomes excessive in cost and time. D.T.

N66-29166# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RAMJET TECHNOLOGY. SECTION ON FLOW PROCESSES AND ENGINE PERFORMANCE. CHAPTER 4: PROPULSION NOZZLES
I. D. V. Faro Feb. 1965 57 p refs
(Contract NOw-62-0604-c)
(TG-610-4; AD-631715) CFSTI: HC $3.00/MF $0.75

Contents: Ideal Nozzle Flows, Nozzle Efficiency, Effect of Recombination in Exhaust Gases, Gas-Particle Nozzle Flows, Conical Nozzles, Contoured Nozzles, Skewed Nozzles, Plug Nozzles, Thrust Vector Control, Movable Nozzles, Deflecting Surfaces, Shock-Induced Deflections, Tabulated Ranges of Parameters in Tables Relevant to Duct Flow. TAB

N66-29168# Bendix Corp., Mishawaka, Ind.
DEVELOPMENT OF A HERMETIC SEALED NITROGEN STORAGE SYSTEM FOR THE TALOS RIM-8E FUEL PRESSURIZATION SYSTEM Final Report
W. B. Claxton 9 Feb. 1966 67 p refs
(Contract NOw-65-0298c)
(BxM-5930; AD-631443) CFSTI: HC $3.00/MF $0.75

The report describes a method used to provide a 2150 psi nitrogen storage system that retains operational pressure for a minimum period of three years without interim servicing. A hermetic tank seal and a squib operated release mechanism were developed for this purpose. The release mechanism utilizes a notched release tube that, when impacted by a squib operated piston, ruptures providing a contamination free path to a pressure regulator. Emphasis was given to methods that would permit retrofit of an existing storage system. Author (TAB)

N66-29171# Office of Naval Intelligence, Washington, D. C. Translations Section.
GUIDED BALLISTIC MISSILES AND THEIR ENGINES [UPRAVLYAYEMYYE BALLISTICHESKIYE RAKETY I IKH AVIGATELI]
G. S. Shchennikov [1966] 15 p Transl. into ENGLISH from Morskoi Sb. (Moscow), no. 3, 1963
(ONI-TRANS-993; AD-631682) CFSTI: HC $1.00/MF $0.50

A technical review is given of ballistic missile trajectory fundamentals, specific thrust, liquid fuel rocket engine operation, solid fuel engine operation, and Tsiolkovskiy's number and initial thrust loading. TAB

N66-29184# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ON THE DETERMINATION OF OPTIMUM SUPERSONIC THRUST NOZZLES OF GIVEN LENGTH FOR A FLOW WITH SWIRL: THEORETICAL PART
Karl G. Gudarley and Daniel Tabak (Illinois Univ., Champaign) Jan. 1966 46 p refs Prepared in cooperation with Illinois Univ.
(ARL-66-0013; AD-631313) CFSTI: HC $4.60/MF $0.50

The problem of maximizing the thrust in supersonic nozzles of given length has been treated previously by Guderley and Rao. Significant differences of the nozzle shapes may be encountered if the oncoming flow possesses a swirl around the axis of symmetry. The present paper extends the existing theory to this case. The final procedure turns out to be more complex, but the basic considerations carry over to the present case. Some space has been devoted to a discussion of a short cut by which Rao succeeded in by-passing the characteristic conditions. The report contains the basic theory only.
Author (TAB)

N66-29286# Payne (Peter R.), Inc., Rockville, Md.
STEADY-STATE THRUST AUGMENTORS AND JET PUMPS Final Report, Jun. 1965–Feb. 1966
Peter R. Payne Mar. 1966 135 p refs
(Contract DA-44-177-AMC-337(T))
(USAAVLABS-TR-66-18; AD-632126) CFSTI: HC $4.00/MF $1.00

The state of the art in steady-state augmentors and jet pumps is briefly reviewed and a general performance theory developed. Generalized charts are presented giving the augmentation ratio obtainable from an optimized eductor, together with the associated geometrical and fluid-dynamic parameters. This theory is shown to give good agreement with experiment. Experimental measurements made by various investigators in the past do not achieve the predicted optimum performance, however, because of various deviations from optimum design in their test eductors. The performance of eductors in an axial stream and the total head rise obtainable through an eductor are both investigated theoretically. The report concludes with a brief survey of various unconventional eductors, including multistage units, Coanda eductors and crypto-steady flow devices.
Author (TAB)

N66-29327*# Giannini Scientific Corp., Santa Ana, Calif. Special Projects Group.
DESIGN AND DEVELOPMENT OF A THERMO-IONIC ELECTRIC THRUSTOR Interim Report
Adriano C. Ducati, Erich Muehlberger, and James P. Todd Feb. 1965 25 p refs Its Rept.-3QSO25-968
(Contract NASw-968)
(NASA-CR-62207) CFSTI: HC $1.00/MF $0.50 CSCL 21C

During the third quarterly period of this program on "Design and Development of a Thermo-Ionic Electric Thrustor" increased attention was given to investigating methods for improving thrustor performance, and experimental work which may lead to a better understanding of the operation of thermo-ionic thrustors. Work was accomplished in several areas. A scaled-down (5 KW) version of a thermo-ionic thrustor was built and tested to give an indication of the effect of scaling. Experiments have been started to determine the effect of varying magnetic field strength on thrustor performance and on the ability of the field to rotate the arc. An investigation has been initiated to determine the importance of errors in thrust measurement caused by interactions between the thrustor and the vacuum chamber gases and walls. A series of tests to evaluate propellants other than hydrogen has been started using deuterium. Author

N66-29344*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
ANALYTICAL METHODS FOR RESISTANCE JET DESIGN Supplementary Report No. 1
Robert Viventi Aug. 1964 67 p refs
(Contract NAS5-9013)
(NASA-CR-62114; R64SD3008) CFSTI: HC $3.00/MF $0.75 CSCL 21H

Analytical methods are presented for designing a resistance jet thruster to be used for station-keeping and attitude control functions of a space vehicle. The steps considered include the thermodynamic design, optimization of the expansion nozzle, length of flow passage, size and life of the heater filament, and radiation heat shielding. The transient performance of the thruster is then calculated, and appropriate modifications can be made if desired, to change the time constant and minimum impulse bit of the thruster. Effects on the vehicle are analyzed; and a procedure is given for designing the thruster so as to minimize the overall weight penalty on the vehicle.
Author

N66-29425*# National Aeronautics and Space Administration, Washington, D. C.
ON THE PECULIARITIES OF THE LONGITUDINAL DISTRIBUTION OF SOLAR ACTIVITY [K VOPROSU OB OSOBENNOSTYAKH DOLGOTNOGO RASPREDELENIYA SOLNECHNOY AKTIVNOSTI]
Yu. I. Vitinskiy Dec. 1963 20 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. v Pulkovo (Leningrad), v. 21, no. 4, 1960 p 98–105
(NASA-TT-F-8722) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A method of using isolines in drawing synoptical solar maps is given for one cycle. It is shown that this method can be applied successfully in recognizing the active regions on the sun. The peculiarities of the longitudinal distribution of various indices of solar activity are considered. The presence of active longitudes for which the Fay law is practically absent is confirmed. It is noted that the main population of active longitudes are recurrent groups. The distribution of the decay function with longitude is considered. It is shown that this distribution differs from that for the sum of daily sunspots for a solar cycle, indicating that decay and outburst processes belong to different depths. It was found that the magnetic strength index of spots is unsuitable for the study of longitudinal distribution.
Author

N66-29448*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NON-CHEMICAL PROPULSION
John C. Evvard [1965] 65 p Presented at the 8th Ann. Missile and Space Technol. Inst., Storrs, Conn., 4–5 Aug. 1965
(NASA-TM-X-50753) CFSTI: HC $3.00/MF $0.75 CSCL 21H

The basic principles of rocket propulsion are reviewed, and the relationship of specific impulse to the performance characteristics of rockets is delineated. Nuclear rocket concepts are examined, and details are given on the Kiwi and NERVA reactor development and test programs. A solar-heated hydrogen rocket idea is briefly discussed. Systems design and constraints associated with electric rocket propulsion are considered, with attention focused on accelerators and on power generation equipment. The research problems involved in developing gaseous core nuclear rockets, in implementing the Orion concept, and in making thermonuclear rockets operational are discussed. The practicality of the photon rocket and the radioisotope sail concepts, and of an antigravity propulsion device is also assessed. M.G.J.

N66-29471*# Aerojet-General Corp., Azusa, Calif.
STUDY OF PRESSURIZATION SYSTEMS FOR LIQUID PROPULSION ROCKET ENGINES Final Report, 15 Apr. 1961–15 Sep. 1962

F. W. Childs, T. R. Horowitz, W. Jenisch, Jr., and B. Sugarman
15 Sep. 1962 120 p refs *Its* Rept.-2335
(Contract NAS5-1108)
(NASA-CR-52780) CFSTI: HC $4.00/MF $0.75 CSCL 21H
(Declassified)

This report presents the results of a comprehensive study to devise a selection technique for propellant pressurization systems. As a result, the likely propellant pressurization systems for advanced space vehicles were determined, and a method of preliminary design and selection of the most suitable of these systems for any specific space mission was provided. Author

N66-29508*# General Dynamics/Convair, San Diego, Calif.
ZERO G REPORT, SETTLING OUTFLOW TEST
T. W. O'Hanlon 25 May 1962 20 p
(NASA-CR-75925; GD/C-55D-859-5) CFSTI: HC $1.00/MF $0.50 CSCL 21H

The Centaur liquid-hydrogen fuel will, during the coast phase, be distributed around in its tank. When the settling rockets fire, the forward part or the liquid will move aft, causing turbulence and sloshing when it reaches the intermediate bulkhead or the LH_2 in that vicinity. The sloshing may appreciably affect the fuel-tank outflow during engine chill down. Tests were instituted to determine how much and in what manner the sloshing effects the outflow. A scale model of the Centaur fuel tank was used to conduct the tests. The top of the tank was modified to allow a portion of the fuel to fall toward the aft bulkhead under a one-g acceleration. The results may be converted by Froude Number scaling to predict full size Centaur sloshing phenomena in any finite acceleration field. Author

N66-29601# Bendix Corp., Mishawaka, Ind.
RAMJET TECHNOLOGY. CHAPTER 7: FUEL SYSTEMS
W. E. Worley Silver Spring, Md., APL, Mar. 1966 156 p refs Prepared for APL Submitted for Publication
(Contract NOw-62-0604-c)
(TG-610-7; AD-630330) CFSTI: HC $5.00/MF $1.00

The design and development of a fuel system for a ramjet engine is discussed. The fuel system, which supplies fuel to the combustion chamber in proper proportion to air flow and in a manner conducive to efficient burning, performs four functions: supply, pumping, regulation, and injection.
Author (TAB)

N66-29638*# Aerojet-General Corp., Sacramento, Calif.
PROPULSION SYSTEM
E. Douglas Ward *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 125-131 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The adaptation of liquid rocket engines developed for Titan II to meet the rigid requirements of the Gemini program are discussed. The stage I and stage II engine systems are described, and schematics are presented. The hardware changes included a malfunction detection system, a prelaunch malfunction detection system, a stability-improvement-program injector, and a redundant engine shutdown system. A propulsion system test program and a Titan II piggyback flight test program were conducted. Details are given on the critical component program, including documentation, testing, packaging, and assembly. Personnel training and certification are mentioned. It was concluded that the successful operation of the engines was exhibited during the launches of the Gemini I-VII missions. N.E.N.

N66-29849# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
RESEARCH STUDY OF LIGHT EMISSION CAUSED BY PRESSURE FLUCTUATIONS IN ROCKET ENGINES Final Report, 1 Jan.-31 Dec. 1965
B. Hornstein, C. Budnik, and W. Courtney Mar. 1966 66 p refs
(Contract AF 49(638)-1505)
(AFOSR-66-0779; AD-632439) CFSTI: HC $3.00/MF $0.75

The program was to investigate the usefulness of spectroscopy as a diagnostic technique for studying combustion instability in a rocket chamber. Main emphasis was given to investigating pressure and the 3064 Å (OH) and 4315 Å (CH) emission as a function of time in order to study the time lag between pressure and emission. The 1100 cps longitudinal mode and the 7100 cps tangential mode in a cylindrical motor 3 inches in diameter and 16 inches long were investigated. Two propellant systems were used, a premixed methane-air gaseous system and a liquid pentane-gaseous air system. Optical results were limited in reproducibility, perhaps because of local turbulent combustion phenomena. Time-averaged spectra indicated no other strong spectral lines in the 2800-4400 Å range but did indicate that a CO+O continuum existed and became more intense as the chamber pressure increased and particularly when non-impinging jet injectors were used with pentane-air system. This intense CO+O continuum obscures the CH emission and severely limits the usefulness of spectroscopy as a diagnostic tool. The initiation and dampening of the 1100 cps longitudinal mode was briefly studied. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-28567# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.
THE SEMINAR ON COSMIC RAYS EXTENSIVE AIR SHOWERS [SEMINARIUM NA TEMAT WIELKICH PEKOW ATMOSFERYCZNYCH PROMIENIOWANIA KOSMICZNEGO]
1965 280 p refs In RUSSIAN Symp. held in Lodz, Poland, 4-8 Jan. 1965 CFSTI: HC $6.00/MF $1.50

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2. ENERGY SPECTRUM AND COMPOSITION OF PRIMARY COSMIC RAYS ACCORDING TO THE DATA PROVIDED BY THE STUDIES OF THE EAS S. I. Nikolski p 36-52 refs (See N66-28569 16-29)

3. THE MU-COMPONENT IN AN ELECTROMAGNETIC CASCADE J. Wdowczyk p 54-99 refs (See N66-28570 16-24)

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6. FACTORS DETERMINING THE MUON SPECTRUM

IN ORDINARY (NUCLEAR) EAS J. Gawin p 119–132 (See N66-28573 16-24)

7. LOW ENERGY NUCLEAR ACTIVE PARTICLES IN EAS T. W. Danilowa p 133–139 refs (See N66-28574 16-24)

8. PERSPECTIVES OF THE RESEARCH INTO EAS S. I. Nikolski p 140–151 refs (See N66-28575 16-29)

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11. STUDY OF THE FLUCTUATIONS IN EAS S. I. Nikolski p 195–203 refs (See N66-28578 16-29)

12. INVESTIGATION OF THE HIGH ENERGY MUONS IN AN UNDERGROUND IONIZATION CALORIMETER A. D. Erlykin p 205–213 refs (See N66-28579 16-24)

13. A TRIAL OF DETERMINING THE RADIAL DISTRIBUTION OF MUONS IN EAS NOT TOO FAR FROM AXIS J. Hibner p 214–226 refs (See N66-28580 16-29)

14. SOME PARAMETERS ON NEON TUBES HODOSCOPE IN CONSTRUCTION J. Jatczak p 227–246 refs (See N66-28581 16-24)

15. THE PROBLEM OF THE POSSIBLE ORIGIN OF THE MU-POOR EAS A. Zawadzki p 247–267 refs (See N66-28582 16-29)

N66-28568# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

THE PRESENT STATE OF THE INVESTIGATION OF MU-POOR EAS [OBECNY STAN PRAC DOTYCZACYCH W.P. UBOGICH W MIONY

A. Zawadzki *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 8–35 refs See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Fluctuations in mu-components of atmospheric cosmic ray showers are analyzed, and the present state of studies dealing with showers deficient in mu-components is discussed. Experimental contributions from these high atmospheric studies are reported, and a comparison is made with previously-reported researches. Transl. by M.W.R.

N66-28569# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

ENERGY SPECTRUM AND COMPOSITION OF PRIMARY COSMIC RAYS ACCORDING TO THE DATA PROVIDED BY THE STUDIES OF THE EAS [WIDMO ENERGETYCZNE I SKLAD PIERWOTNEGO PROMIENOWANIA KOSMICZNEGO WEDLUG DANYCH OTRZYMANYCH Z BADANIA WIELKICH PEKOW]

S. I. Nikolski *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 36–52 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Physical aspects of composition of primary cosmic ray showers in the higher regions of the galaxy are discussed. Separate determinations are made for showers with energies less than and greater than 10^{15} eV, and attention is given to the energy spectrum of high intensity primary cosmic ray emissions. Transl. by M.W.R.

N66-28575# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

PERSPECTIVES OF THE RESEARCH INTO EAS [PERSPEKTYWY BADAN WIELKICH PEKOW]

S. I. Nikolski *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 140–151 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

General procedures and processes employed during research on the Extensive Atmospheric Showers (EAS) program are reviewed, with emphasis on the study of ultrahigh energy particles. Measuring devices for cosmic ray studies are discussed and illustrated. Transl. by M.W.R.

N66-28576# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

THE BAROMETRIC EFFECT OF MU-COMPONENT OF EAS [EFEKT BAROME TRYCZNY SKLADOWEJ MIONOWEJ W WIELKICH PEKOW]

R. Firkowski *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 153–158 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Coefficients of barometric effect of mu-components in cosmic ray showers are determined, with pertinent formulas included. The electron charge beams for muons are discussed, as are energy loses during ionization, and collapse due to disintegration. Transl. by M.W.R.

N66-28578# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

STUDY OF THE FLUCTUATIONS IN EAS [BADANIE FLUKTUACJI WIELKICH PEKOW]

S. I. Nikolski *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 195–203 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

High energy nuclear radiation characteristics of cosmic ray showers are considered, and the fluctuations in these atmospheric emissions are discussed. Attention is given to the generation of primary radiation and to differentiation bewean the various types of radiation in cosmic ray showers in the atmosphere. Transl. by Transl. by M.W.R.

N66-28580# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

A TRIAL OF DETERMINING THE RADIAL DISTRIBUTION OF MUONS IN EAS NOT TOO FAR FROM AXIS [PROBA WYZNACZENIA ROZKLADU PRZESTRZENNEGO MIONOW WIELKICH PEKACH DLA NIEWIELKICH ODLEGLOSCI OD OSI]

J. Hibner *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 214–226 refs (See N66-28567 16-20) CFSTI: HC $6.00/MF $1.50

A method for the localization of radiation axes for the distribution of muons in cosmic ray showers is discussed in terms of determining radial distributions. The experimental arrangement is detailed for such high atmospheric radiation studies. Transl. by M.W.R.

N66-28582# Polish Academy of Sciences, Warsaw. Dept. of High Energy Physics.

THE PROBLEM OF THE POSSIBLE ORIGIN OF THE MU-POOR EAS [ZAGADNIENIE EWANTUALNEGO POCHODZENIE WIELKICH PEKOW UBOGICH W MIONY]

A. Zawadzki *In its* Seminar on Cosmic Rays Extensive Air Showers 1965 p 247–267 refs (See N66-28567 16-29) CFSTI: HC $6.00/MF $1.50

Various hypotheses are considered for the origin of cosmic ray atmospheric showers which are deficient in mu-components. It is concluded that if the Hayakawa hypothesis offers the correct explanation, then the ionizing radiation which is

poor in muon content may be determined by the average production of high temperature photons in the metagalaxy and the amount of total radiation. Transl. by K.W.

N66-28666*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
THEORETICAL STUDIES OF SPACE PLASMA Summary Report, 3 May 1965–1 May 1966
David B. Chang, Nicholas A. Krall, L. D. Pearlstein and M. N. Rosenbluth [1966] 274 p refs
(Contract NASw-1211)
(NASA-CR-75542; GA-7119) CFSTI: HC $6.00/MF $1.50
CSCL 20H

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2. FINITE β EFFECTS IN A WEAKLY UNSTABLE PLASMA L. D. Pearlstein and N. A. Krall p 21–43 refs (See N66-28668 16-25)

3. HIGH-FREQUENCY "LOSS-CONE" FLUTE INSTABILITIES INHERENT TO TWO-COMPONENT PLASMAS L. D. Pearlstein, M. N. Rosenbluth, and D. B. Chang p 45–58 refs (See N66-28669 16-25)

4. IONOSPHERIC STABILIZATION OF THE INTERCHANGE MODE L. D. Pearlstein p. 59–70 refs (See N66-28670 16-29)

5. ON THE INTERACTION OF PLASMONS D. B. Chang p 71–100 refs (See N66-28671 16-25)

6. EFFECT OF A UNIVERSAL INSTABILITY ON AURORAL BOMBARDMENT N. A. Krall p 101–113 refs (See N66-28672 16-29)

7. FINITE-β RESISTIVE INSTABILITIES OF MAGNETOSPHERIC TAILS M. N. Rosenbluth and D. B. Chang p 115–161 refs (See N66-28673 16-29)

8. SOME PLASMA INSTABILITIES OF THE MAGNETOSPHERE D. B. Chang p 163–189 refs (See N66-28674 16-29)

9. SYNCHROTRON RADIATION FROM A DIPOLE FIELD N. R. Ortwein, D. B. Chang, and L. Davis, Jr. 68 p refs (See N66-28675 16-29)

N66-28670*# General Dynamics Corp., San Diego, Calif.
IONOSPHERIC STABILIZATION OF THE INTERCHANGE MODE
L. D. Pearlstein 1966 *In its* Theoret. Studies of Space Plasmas [1966] p 59–70 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-6987)

Results of a calculation applied to the electron debris from the Star Fish event show that with daytime ionospheric parameters, the effect of the ionospheric currents is to stabilize the interchange mode. For the more sporadic values during nighttime, and with the initial number of trapped electrons the stability criterion is violated. Stability would occur if the ratio of energetic electrons to ionospheric electrons on a given tube of flux were small enough. The final stability criterion is obtained; and this can be applied to particles distributed smoothly over distances greater than the earth's radius as long as the density drops off rapidly enough at its outer boundary. M.W.R.

N66-28672*# General Dynamics Corp., San Diego, Calif.
EFFECT OF A UNIVERSAL INSTABILITY ON AURORAL BOMBARDMENT
Nicholas A. Krall *In its* Theoret. Studies of Space Plasmas [1966] p 101–113 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-7114)

Time evolution is calculated and associated particle diffusion is estimated for a low frequency universal plasma instability which is pure transverse and which may account for auroral characteristics such as damping, ray structure, north-south thinness of formations, simultaneous electron–proton bombardment, and angular and velocity distribution of auroral primaries. A quasi-linear approach is followed in which the distortion of the plasma distribution function is considered due to the interaction with the waves. The resultant approximation presents the particle velocity distribution function as the sum of a slowly varying and a rapidly oscillating function. It is expected that the energy released by reducing the density gradient will appear as mode energy and as an increase in the energy of parallel oscillations. Upward drift has no effect on diffusion in closed or infinite systems, but can cause escape through the loss cone of a magnetic mirror system, such as in the radiation belt. M.W.R.

N66-28673*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
FINITE-β RESISTIVE INSTABILITIES OF MAGNETOSPHERIC TAILS
M. N. Rosenbluth and David B. Chang *In its* Theoret. Studies of Space Plasmas [1966] p 115–161 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-7087)

The decoupled-flow regions of resistive instabilities occurring in magnetospheric tails are sufficiently narrow that magnetic and collisional viscosities may be of importance. To determine the effects of these viscosities, the resistive instabilities studied in hydromagnetic approximation are studied with expanded plasma equations. Treating the ratio β of the plasma pressure to magnetic pressure to be of order unity, three cases are considered: two lead to tearing instabilities and the third gives a gravitational instability. In all three cases the hydromagnetic equations are applicable when the ion collision frequency is larger than the ion gyro-frequency. When the ion gyro-frequency exceeds the ion collision frequency, the results are qualitatively the same except that ion–ion collisions replace ion inertia in determining the growth rates and the size of the decoupled flow region. The conditions under which the Hall currents become important are defined. Author

N66-28674*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
SOME PLASMA INSTABILITIES OF THE MAGNETOSPHERE
David B. Chang 1965 *In its* Theoret. Studies of Space Plasmas [1966] p 163–189 refs (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50
(GA-6696)

Four plasma instabilities which may operate in planetary magnetospheres are described: (1) the low frequency Rayleigh–Taylor flute-type instability as affected by a resistive ionosphere, a dipole field geometry, and by resonant particle-wave interactions, (2) a whistler instability, with the concomitant particle diffusion, which occurs in a plasma containing a small component of flat-helix energetic electrons, (3) a nonconvective high frequency two energy component electrostatic loss-cone instability, and (4) the resistive instabilities

occurring in sheared magnetic fields, as affected by the Chapman and Cowling collisional and magnetic viscosities and Hall currents. Author

N66-28875*# General Dynamics Corp., San Diego, Calif. General Atomic Div.
SYNCHROTRON RADIATION FROM A DIPOLE FIELD
N. R. Ortwein (Navy Electron. Lab.), David B. Chang, and Leverett Davis, Jr. (Calif. Inst. of Tech.) *In its* Theoret. Studies of Space Plasmas [1966] 68 p refs Repr. from Astrophys. J. Suppl. Series, v. 12, no. 111, Feb. 1966 p 323-389 (See N66-28666 16-29) CFSTI: HC $6.00/MF $1.50

Tables of the two-dimensional distribution of Stokes parameters for synchrotron radiation from ultra-relativistic electrons in a dipole field are compiled for various energy and spatial distributions, and for varying angles between the dipole axis and the line of sight. Author

N66-28901*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ELECTROMAGNETIC RADIATION IN SPACE
Francis J. Clauss *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1964] 58 p refs (See N66-28899 16-11) CFSTI: HC $4.00/MF $1.00

Design, testing, and operation of spacecraft are discussed in terms of the effects of electromagnetic radiation in space. Direct solar radiation, albedo radiation, and planetary emission are considered, along with their effects on spacecraft temperature. Control of thermal balance of the spacecraft is discussed, and the effects of surface radiative properties on the temperature of satellites is illustrated. Approaches used to verify the thermal design of spacecraft are the simulation of thermal conditions, absorbed radiation, and incident radiation. Three covering systems are proposed for solar cells, and photochemical effects and the photodegradation of thermal control surfaces and optical adhesives in solar cells are discussed. Quartz-enclosed tungsten filament lamps, carbon arc lamps, and high-pressure discharge lamps are considered for the simulation of electromagnetic radiation. M.W.R.

N66-28904*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELDS: REASONS FOR SIMULATION AND METHODS AVAILABLE
Norman F. Ness *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1964] 35 p refs (See N66-28899 16-11) CFSTI: HC $4.00/MF $1.00

Spatial environment of the earth with respect to magnetic field, related satellite measurements and other space probes, and techniques for simulating magnetic fields are described. Results from various space studies are reviewed, and it is concluded that the very weak magnetic fields observed in the magnetosphere, turbulent boundary layer, and interplanetary medium regions of space must be simulated on the surface of the earth. Geomagnetic and interplanetary fields representation are discussed, and pertinent formulas are included. Requirements for magnetic field simulation and existing optimum coil systems for such simulation are summarized; as are the spin decay investigation on Vanguard I, passive magnetic orientation observed by Injun III, and Tiros active attitude control. M.W.R.

N66-28907# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
PROCEEDINGS OF THE REGIONAL SYMPOSIUM OF THE INTERNATIONAL YEARS OF THE QUIET SUN, VOLUME II
1965 73 p refs Symp. held Aug. 1964 *Its* Spec. Publ. No. 7 (Grant AF-AFOSR-716-65)
(CNIE-PE-7) CFSTI: HC $3.00/MF $0.75

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1. OBSERVATIONS OF THE ATMOSPHERIC SCINTILLATION OF RADIO STAR AND SATELLITE SIGNALS J. Aarons, R. Allen, H. Whitney, and L. Katz (AFCRL) 14 p ref (See N66-28908 16-30)

2. APPLICATIONS OF THE OPTICAL MODEL FOR 2 Bev/c K^- INTERACTIONS F. Ayer, L. Marshall (Colo. Univ.), and T. Oliphant (Los Alamos Sci. Lab.) 7 p refs (See N66-28909 16-24)

3. DIRECTIONAL AND ENERGY DEPENDENCE OF COSMIC-RAY VARIATIONS W. Hassler, J. Sans, A. Sittkus, and G. Stiller (Max-Planck-Inst. fuer Kernphysik) 13 p refs (See N66-28910 16-29)

4. COSMIC RAY FLUXES AND RIGIDITY CALCULATIONS J. F. Kenney, J. Gauger (Boeing Sci. Res. Labs.), M. A. Shea (Emmanuel Coll.), and D. F. Smart (AFCRL) 9 p (See N66-28911 16-29)

5. DIFFERENTIAL FARADAY MEASUREMENT OF ELECTRON CONTENT WITH THE S-66 SATELLITE F. de Mendonca and J. L. R. Muzzio (Comissao Nacional de Atividades Espaciais) 8 p refs (See N66-28912 16-30)

6. COSMIC RAY STORMS AND THE DAILY VARIATION A. E. Sandstroem (Uppsala Univ.) 7 p refs (See N66-28913 16-29)

N66-28910# Max-Planck-Institut für Kernphysik, Heidelberg (West Germany).
DIRECTIONAL AND ENERGY DEPENDENCE OF COSMIC-RAY VARIATIONS
W. Hassler, J. Sans, A. Sittkus, and G. Stiller *In* Comision Nacl. de Invest. Espaciales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 13 p refs (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

Using the results of measurements taken with two arrangements of different directional response but equal energy sensitivity, the directional properties of cosmic radiation during the period from July, 1958, to December, 1962, were investigated. An anisotropy of the long-term intensity increase was found for the present 11-years' cycle. The change in the directional distribution appears to be of the same kind as that observed in those quiet periods during which the cosmic radiation exhibits, in absence of storms, disturbances correlated with geomagnetic effects. The variation of the directional distribution was weak or absent in periods which were quiet with regard to both geomagnetic and cosmic radiation. The same also holds for the slow intensity decrease of cosmic radiation after the last maximum of solar activity in 1957. For cosmic-ray storms (Forbush decreases) the following features were observed: A storm setting in on a normal directional distribution causes a characteristic modulation of this distribution. But if before the storm a marked deviation of the directional distribution already existed, the resultant of the two types of modulation can be a strengthening or a weakening of the anisotropy. Author

N66-28911# Boeing Scientific Research Labs., Seattle, Wash.
COSMIC RAY FLUXES AND RIGIDITY CALCULATIONS

J. F. Kenney, J. Gauger, M. A. Shea (Emmanuel Coll.), and D. F. Smart (AFCRL) *In* Comision Nacl. de Invest. Espaciales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 9 p (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

In the past two years, the cosmic radiation has been periodically measured by equipment mounted on a high-flying aircraft. The counting rate of the various detectors has been determined as a function or position on the surface of the earth. These rates are compared with those predicted on the basis of various vertical cut-off rigidity calculations, ranging from a crude dipole approximation to the exact computations of Shea and Smart. The usefulness of the L coordinate as a substitute for rigidity calculations when applied to the cosmic radiation is discussed. Furthermore, it is shown that the penumbral region must be treated carefully if accurate values of vertical cut-off rigidity are desired, particularly in certain portions of the world. Author

N66-28913# Uppsala Univ. (Sweden). Cosmic Ray Group.
COSMIC RAY STORMS AND THE DAILY VARIATION
Arne Eld Sandstroem *In* Comision Nacl. de Invest. Espaciales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 7 p refs (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

Cosmic ray storm classification is reviewed. The types of storms are outlined, and are accompanied by typical diagrams. The diurnal variation effect of the cosmic ray storms is discussed. The problems areas are indicated, and it is stated that the yearly mean diurnal variation can serve for references of the phase shifts during a storm. The distribution of particles over the cones corresponding to successive rigidity regions is mentioned. Some specific storms are described. N.E.N.

N66-29133# Case Inst. of Tech., Cleveland, Ohio.
DEEP LAB CONFERENCE
Frederick Reines [1965] 41 p Conf. held in Johannesburg, 12 Oct. 1965
(Grant Nonr(G)-00034-65)
(AD-631479) CFSTI: HC $2.00/MF $0.50

The usefulness to neutrino and cosmic ray research of a very deep underground laboratory housed in a spherical cavity 100 feet in diameter and 15,000 feet below the surface is described. It appears from this meeting that the two major problems in providing such a location, i.e. temperature and mechanical strength, can be solved within existing technology. Various locations in the United States and South Africa which seem most suitable for such a laboratory were mentioned and the merits of locating below an existing mine, e.g. Anglo-American's Western Deep Levels west of Johannesburg, were discussed. The estimated cost of the laboratory ranged from 4 to 40 million dollars and the time for construction ranged from under two to eight years, depending on the location. Author (TAB)

N66-29333*# National Aeronautics and Space Administration, Washington, D. C.
THE ELEVEN-YEAR VARIATION CYCLE OF THE BRIGHTNESS, FORM AND DIMENSIONS OF THE COUNTERGLOW
I. S. Astapovich Dec. 1963 4 p refs Transl. into ENGLISH from Astron. Tsirkuliar Akad. Nauk SSSR (Kazan), v. 190, 1958 p 25-26
(NASA-TT-F-8721) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The counterglow, in the period of minimum solar activity (1942 to 1943 and 1951 to 1953), appears to be "compressed" as it were, has a minimum latitude (~7° to 8°) and longitude (~13°), and is shaped like an ellipse, its large axis being parallel with the elliptic. The counterglow is, on the whole, not very bright and is not visible every night under average conditions. During the periods of maximum solar activity (1947 to 1948 and 1956 to 1957), the counterglow becomes considerably brighter. It is seldom seen as compressed or elliptical, and usually covers a hugh area (hundreds of square degrees of the celestial sphere). It has a very irregular outline which may be seen several nights in a row or may change within a single night. Thus, it appears that the counterglow undergoes changes, during the eleven-year cycle of solar activity, similar to those of the solar corona. I.v.L.

N66-29345*# Consultants and Designers, Inc., Arlington, Va.
PHYSICS OF COSMIC RAYS [FIZIKA KOSMICHESKIKH LUCHEY]
G. D. Zhdanov Greenbelt, Md., NASA. Goddard Space Flight Center, Apr. 1964 11 p Transl. into ENGLISH from Priroda (Moscow), no. 2, Feb. 1964 p 82-87
(Contract NAS5-2078)
(NASA-TT-F-8684; ST-CR-10124) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Reports delivered by young Soviet scientists at a conference on cosmic rays are briefly reviewed. New instruments and methods are included; the introduction of Cerenkov computers and the use of controlled photographic emulsion instead of ionization chambers are discussed. Research in the field of space physics included mastering various processes of natural acceleration of particles and using these particles as an instrument for cosmic space sounding, and calculations of the earth's radiation belts and magnetic field. In the area of nuclear physics research, the fireball phenomenon is reviewed. A schematic of peripheral interaction of high energy nucleons with virtual mesons and the fireball is included. Various theories of the origin of cosmic rays are mentioned, and the possibility that their verification may come from analysis of the isotropic composition of meteorite matter is suggested. L.E.W.

N66-29354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADVANCES IN PARTICLES AND FIELD RESEARCH IN THE SATELLITE ERA
W. Hess, G. Mead, and M. P. Nakada Jan. 1965 68 p refs Submitted for Publication
(NASA-TM-X-55240; X-640-65-39) CFSTI: HC $3.00/MF $0.75 CSCL 20H

This document attempts to summarize the advances that have been made in particles and fields research in the satellite era and concentrates on those subjects about which man's understanding has increased most dramatically since 1958. New findings and accomplishments in the areas of the solar wind and its effect on the earth, the radiation belts, the earth's magnetic field, solar energetic particles and ground effects, cosmic rays, and neutrons are discussed. R.N.A.

N66-29366*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FLUID MODEL FOR THE INTERACTION OF THE SOLAR WIND AND THE GEOMAGNETIC FIELD
John R. Spreiter, Augrey L. Summers, and Alberta Y. Alksne [1965] 19 p refs Submitted for Publication.
(NASA-TM-X-56892) CFSTI: HC $1.00/MF $0.50 CSCL 08N

Systems of equations are presented for describing the interaction of the solar wind and the geomagnetic field in terms of a continuum theory of fluid flow. A procedure is

indicated by which the results for the magnetosphere boundary, the bow wave, and the associated flow field can be arrived at from a purely fluid point of view without resort to a mixture of particle and fluid models as usually employed; and numerical results for the flow parameters in the shock layer between the bow wave and the magnetosphere boundary are presented. The fundamental assumption is that the flow can be described adequately by the standard magnetohydrodynamic equations for steady flow of a dissipationless perfect gas. Data curves from the literature relating to streamlines, waves patterns, constant velocity, mass flux, density, and temperature for supersonic flow past the magnetosphere are included. L.S.

N66-29424*# National Aeronautics and Space Administration, Washington, D. C.

'ROLE AND SOURCE OF CORPUSCLES OBSERVED IN THE IONOSPHERE AND AURORAS [ROL' I ISTOCHNIK KORPUSKUL, NABLYUDAYUSHCHIKHSYA V IONOSFERE I POLYARNYKH SIYANIYAKH]

G. S. Ivanov-Kholodnyi Dec. 1963 31 p refs Transl. into ENGLISH from Kosmicheskie Luchi (Moscow), no. 5, 1963 p 154–170

(NASA-TT-F-8719) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A review is given of studies of electron fluxes, penetrating fairly deeply into the earth's atmosphere. The paper describes experimental data on the intensity and energy spectrum of particles propagating through the ionosphere and the aurorae. Powerful electron fluxes observed in the atmosphere at the heights of 100 to 1,000 km carried the inflow of energy of 0.1 to 1 erg/cm^2 sec to the ionosphere, which was necessary to maintain the night ionization and atmospheric warming. A number of indirect data shows that the source of these electrons is in the ionosphere, and not in the radiation belts. The latter themselves are evidently the result of the effect of these acceleration mechanisms, in which some part of particles may get to the trapping trajectory. The concrete mechanism of particle accelerations and their source is not clear. Author

N66-29432*# Consultants and Designers, Inc., Arlington, Va.

X-RAY EMISSION OF FLARES ORIGINATING BEHIND THE SOLAR DISK [RENTGENOVSKIYE IZLUCHENIYA VSPYSHEK VOZNIKAYUSHCHIKH ZA LIMBOM SOLNECHNOGO DISKA]

Yu. T. Vinogradov and N. N. Yeryushev 20 Nov. 1963 10 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 29, 1963 p 141–145

(Contract NAS5-2078)

(NASA-TT-F-8641; ST-SP-10069) CFSTI: HC $1.00/MF $0.50 CSCL 20H

In some cases, sudden ionospheric disturbances (SID) are observed when there are no solar flares on the solar disk. Eighteen such cases were observed during 1959. It is shown that the observed SID's were due to flares occurring behind the limb of the solar disk. Recordings of the integral intensity of atmospherics in the long-wave band were used as indicators of the SID. Author

N66-29451*# California Univ., La Jolla. Dept. of Physics.

EXPERIMENTS IN X-RAY AND GAMMA-RAY ASTRONOMY

Laurence E. Peterson [1965] 28 p refs Presented at the NASA–University Program Review Conference, Kansas City, Mo., 1–3 Mar. 1965

(Contracts NAS5-3122; NAS5-3177; NASw-56; Grant NsG-318)

(NASA-CR-64398) CFSTI: HC $2.00/MF $0.50 CSCL 04A

To study cosmic photons in the general range of 10 keV to 5 MeV, satellite-borne instruments, and an Orbiting Solar Observatory (OSO) and radiation detectors were used for astronomical observation and measurements. Preliminary balloon investigations, conducted to plan and design experiments for cosmic photon measurements in this general energy range and to interpret OSO results, culminated in the development of an X-ray detector. A functional diagram of an exploratory experiment in gamma-ray astronomy is presented, and the rates of the isotropic gamma-ray detectors on the OSO-1, as a function of geographic latitude, are given. The upper limits of the search for cosmic fluxes from the OSO-1 compared with other measurements are shown graphically. The differential spectrum of measured cosmic X-ray fluxes is also included. R.Li.

N66-29460*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A SEARCH FOR THE QUIET TIME SOLAR GAMMA RAYS FROM BALLOON ALTITUDES

K. J. Frost, E. D. Rothe, and Laurence E. Peterson (Minnesota Univ.) Jan. 1966 38 p refs Submitted for Publication Prepared in part at Minnesota Univ. and California Univ., La Jolla

(Contracts NASw-56; NAS5-976; Grant NsG-318)

(NASA-TM-X-55450; X-614-66-21, Rev.) CFSTI: HC $2.60/MF $0.50 CSCL 04A

A balloon observation at 3.5 gm/cm^2 has resulted in upper limits from the quiet sun of less than 0.05 counts/cm^2-sec over the range 160 to 800 keV. This limit is considerably below those previously available. The detector consisted of a 3.4 cm dia by 5.4 cm NaI crystal surrounded, except for a one steradian forward aperture, by a 14.6 cm dia and 19.0 cm long CsI collimating shield connected in active anti-coincidence. The detector was servo-controlled to observe the sun, 180° in azimuth from the sun, as well as vertical, horizontal and downward. The differences between the rates pointing to and away from the sun give upper limits for the solar flux at a 95% confidence level of 0.058, 0.048, 0.050, and 0.043 counts/cm^2-sec-MeV over the 163–325, 325–488, 488–651, and 651–774 keV range respecitvely. Since the Crab Nebula was in the detector aperture during the flight these upper limits also apply to that object. Author

N66-29475*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

INVERSE L TO I TRANSFORMATION

E. G. Stassinopoulos Apr. 1966 20 p

(NASA-TM-X-55502; X-642-66-273) CFSTI: HC $1.00/MF $0.50 CSCL 20H

It is shown that the second adiabatic invariant I may be defined as a function of the magnitude of the field B and shell parameter L. A method is developed to obtain solutions for I in terms of arbitrary B and L. Results are tested and discussed. Author

N66-29510*# TRW Systems, Redondo Beach, Calif. Space Sciences Lab.

CONDUCTIVE HEATING OF THE SOLAR WIND. III: BREAKDOWN OF THE NAVIER-STOKES EQUATIONS, 4 JUNE–4 DECEMBER 1965

F. L. Scarf [1965] 11 p refs

(Contract NASw-1226)

(NASA-CR-75929) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The validity of the Navier-Stokes equations with conventional transport coefficients in predicting the solar wind flow pattern near the earth is examined. It is stated that the validity

of these equations becomes questionable before the earth is reached. By introducing viscous terms into the Navier–Stokes equations, relationships were derived which describe spherically symmetric flow. It is stated that these equations are appropriate when examining subsonic flow; however, numerical integration of these equations confirmed the expectation that error is possible when the flow is supersonic. It was expected that viscous dissipation would yield a lower flow speed relative to the sun, and not a higher one. The reason for this was found by attempting to vary the Prandtl number to approach B=0; a discussion of this finding is included. Additionally the investigations into the solar wind flow beyond (15–20)$R_{\odot}$ are summarized. H.S.W.

N66-29662# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE POLARIZATION OF CELESTIAL X-RAYS

Joseph F. Dolan 20 May 1966 124 p refs

(SAO Special Rept.-212)

The processes by which X-radiation may be emitted by celestial sources are investigated, and the net polarization such radiation would possess is predicted. The amount of polarization observed at the earth would depend both on the mechanism producing the radiation and on the fractional extent of the source over which it is coherently polarized. Highly polarized X-radiation would suggest synchrotron emission as the source mechanism. Radiation whose polarization is low but nonzero would be produced by synchrotron emission from a source whose magnetic fields are inhomogeneous on a large scale, or by bremsstrahlung of electrons whose velocity vectors lie in one predominant direction. Nonobservable polarization would result from sources of synchrotron radiation whose magnetic fields showed small-scale irregularities, from the bremsstrahlung of electrons whose velocity vectors are either random or spherically symmetric in direction over the entire source, or from sources whose mechanism of producing the radiation imparts no net polarization. Author

N66-29721*# National Aeronautics and Space Administration, Washington, D. C.

BALANCE OF ENERGY AND STRUCTURE OF THE CHROMOSPHERE

E. Ye. Dubov Jul. 1966 28 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 22, 1960 p 101–117

(NASA-TT-F-8793) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Developed in the following is the concept of heating of the chromosphere by compression waves originating in the regions of turbulence related to the convective zone of the sun. It is shown that within the chromosphere a balance can be reached between the energy resulting from the dissipation of shock waves and the energy carried off by radiation. Shock waves cause the appearance in the chromosphere of regions having differing temperatures (a two-temperature chromosphere). It is shown that the dissipation of magnetohydrodynamic waves cannot provide a sufficient quantity of energy because of losses due to friction. An explanation is provided for the lowering of the chromosphere above spots. The value of the density gradient in the chromosphere is discussed. An attempt is made to formulate a general idea about the chromosphere and the cause for its formation. The entire structure of the chromosphere is determined mainly by the value of the energy flux in acoustic noises generated by the turbulence produced in the convective zone of the sun. Author

N66-29739*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.

THE STRUCTURE OF THE SOLAR PLASMA FLOW GENERATED BY SOLAR FLARES

S.-I. Akasofu and S. Yoshida Apr. 1966 52 p refs Prepared jointly with Alaska Univ. *Its* Rept.-66-16

(Grants NsG-201-62; NsG-233-62)

(NASA-CR-76013) CFSTI: HC $3.00/MF $0.50 CSCL 20I

Characteristics of geomagnetic storms caused by solar flares at different central meridian distances are statistically examined to obtain a two dimensional configuration of the solar plasma flow generated by solar flares. It is shown that the front of the plasma flow is nearly semi-spherical, but its energy flux is greatly concentrated in a narrow cone from intense solar flares; therefore, the energy flux has a jet structure. It is shown that these results can be reasonably combined to give a consistent picture by assuming the generation of an interplanetary shock wave by the jet of the solar plasma ejected by a solar flare. Author

N66-29805# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

PHYSICAL PICTURE OF THE FORMATION OF AN ARTIFICIAL RADIATION BELT BY THE AMERICAN HIGH-ALTITUDE THERMONUCLEAR BURST OF 9 JULY 1962

Yu. I. Gal'perin 11 Mar. 1966 17 p refs Transl. into ENGLISH from Issled. Kosmicheskogo Prostranstva (USSR), Spec. Issue, 1965 p 388–393

(Contract NOw-62-0604-c)

(TG-230-T466; TT-66-61005; AD-631025) CFSTI: HC $1.60/MF $0.50

Direct observations by Kosmos-5 and other satellite sources indicate that the final radius of the plasma cloud accompanying the American high-altitude burst of 9 July 1962 did not exceed 600 km. This is less than the final radius for a plasma cloud expanding in a vacuum, which indicates considerable dissipation of energy. Particle ejection beyond the plasma cloud is assumed to be the reason for this discrepancy and three mechanisms are proposed to explain the ejection: (1) diamagnetic ejection of plasma blobs due to instability at the interface between plasma and field; (2) free separation in the magnetosphere of fission fragments neutralized in the beginning stages of cloud expansion, i.e., before the stage of inertial separation; (3) free separation in the magnetosphere of fragments neutralized by charge exchange between ions in the plasma cloud and neutral particles in the atmosphere. Author (TAB)

N66-29830# American Science and Engineering, Inc., Cambridge, Mass.

MEASUREMENTS IN THE RADIATION BELTS FROM HITCH-HIKER I

F. R. Paolini, R. Giacconi, J. R. Waters, L. Katz, and D. Smart (AFCRL) Bedford, Mass., AFCRL, Jun. 1965 30 p refs Repr. from Space Res. V, Proc. of the 5th Intern. Space Sci. Symp., Florence, 8–20 May 1964 p 466–488 *Its* Environ. Res. Paper No. 106

(Contract AF 19(628)-2392)

(AFCRL-65-377; AD-618171)

The Air Force sub-satellite Hitch-hiker I was launched into an elliptical polar orbit on 1 July 1963. The satellite carried a payload which included six radiation detection instruments for simultaneously investigating the energy spectra and angular distributions of protons and electrons in the Earth's magnetosphere over a broad range of energies. Data from an orbit of 4 July show qualitative differences in the structures

of the radiation belts defined by the different energy bands investigated. Electrons of energies greater than 4 MeV (as detected by a Geiger counter) define two distinct zones with hearts at L = approx. 1.6 and L = approx. 4.5, with a pronounced slot between them at L = approx. 3.0. Electrons of energies between 1 and 4 MeV behave similarly. Protons of energies between 1 and 4 MeV are also found to lie in two zones, congruent with the electron zones, but with the outer one not so well pronounced. Electrons of energies between 15 and 100 keV define a single zone, extending beyond L = approx. 6.9, and with a heart around L = approx. 1.6. Differential spectra of electrons from 15 to 100 keV, measured with a 15% resolution, exhibit maxima around 40 keV over an extensive region of the magnetosphere, L<4, but monotonically decrease from 15 keV in regions beyond L = approx. 4.
Author (TAB)

N66-29959# RAND Corp., Santa Monica, Calif.
A COMPUTATIONAL APPROACH TO CHANDRASEKHAR'S PLANETARY PROBLEM
R. Bellman, H. Kagiwada, R. Kalaba, and S. Veno May 1966 27 p refs
(Contract AF 49(638)-1700)
(RM-4991-PR; AD-632231) CFSTI: HC $2.00/MF $0.50

Chandrasekhar's planetary problem is reformulated using an initial-value approach. The problem concerns the diffuse reflection of radiation from a finite atmosphere with a reflecting surface at the bottom. In the direct problem, the angular distribution of multiple-scattered radiation is computationally obtained as the solution of an initial-value problem for ordinary differential equations for S, a generalization of the Chandrasekhar scattering function for an inhomogeneous atmosphere. In the inverse planetary problem, the properties of the atmosphere and the surface are to be estimated, given the angular distribution of scattered radiation. The quasi-linearization technique for nonlinear multipoint boundary-value problems provides an effective method for obtaining a computational solution to the inverse problem. A Fortran program for both the direct and inverse problems is presented in the appendix.
Author (TAB)

N66-29968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR MODULATION OF GALACTIC COSMIC RAYS
V. K. Balasubrahmanyan, E. Boldt, and R. A. R. Palmeira May 1966 38 p refs
(NASA-TM-55500; X-611-66-226) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The modulation of galactic protons and He nuclei during the last solar cycle is analyzed according to Parker's theory. The mechanism of modulation remains essentially the same during several years of low solar activity (1961–1965). The modulation near solar maximum (1959) implies that the scale sizes of the magnetic inhomogeneities in the solar wind are reduced below the values at solar minimum. An adequate description at solar maximum would require further refinements of the theory. The proton to He nucleus ratio outside the solar system is shown to be consistent with a value ≈6, in a kinetic-energy/nucleon representation for the interval 50 to 1000 Mev/nucleon.
Author

N66-29971*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
GALACTIC DEUTERIUM AND ITS ENERGY SPECTRUM ABOVE 20 MeV PER NUCLEON
C. Y. Fan, George Gloeckler, and J. A. Simpson [1966] 18 p refs
(Grants NsG-178-61; AF 49(638)-1642)
(NASA-CR-76073; EFINS-66-58) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The fluxes and energy spectra of deuterium, protons and helium were measured on the IMP-III satellite at a time near minimum solar activity. The deuterium differential energy spectrum in the range 17–63 MeV/nucleon is $\propto E^{+2}$ and, at 60 MeV/nucleon, the relative abundance ratios are $H^2/He^4 = 0.15$ and $H^2/H^1 = 0.05$. If present values of experimental cross-sections for the production of H^2 from nucleon interactions with He^4 are used, the observed deuterium abundance may be accounted for by the traversal of He^4 through 4 to 8 gm/cm^2 of matter in cosmic ray sources and the interstellar medium.
Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-28482*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
INVESTIGATION OF SPUTTERING EFFECTS ON THE MOON'S SURFACE Quarterly Status Report No. 12, 25 Jan.–24 Apr. 1966
G. K. Wehner, C. E. Ken Knight, and D. L. Rosenberg 25 May 1966 59 p refs *Its* Rept.-2986
(Contract NASw-751)
(NASA-CR-75697) CFSTI: HC $3.00/MF $0.50 CSCL 03B

Attempts to build up thick crusts of powders which are ion bombarded during deposition and the study of changes in the permeability of solid rock samples due to ion bombardment were continued. A summary of the optical properties of the moon in comparison to those of ion bombarded powder samples is given in preparation for publishing the work of the last three years. Trends in sample color due to composition differences are presented. Though the color of lunar features should permit identification of composition differences after taking decoloration effects of the solar wind into account, positive identification is not now possible. A number of properties of the lunar photometric function plus the polarization of earthshine are shown to be incapable of proving whether the lunar surface is underdense or compacted. The photometric function reveals that the lunar surface has a rough macrostructure, the form of which may correspond in general to that seen in the photographs of Luna 9. The earlier conclusion that the polarization of moonlight is in good agreement with that of light scattered from powders whose particles are mostly less than 0.1 mm in size is not modified by the latest consideration of composition, density, and roughness of the lunar surface layer.
Author

N66-28585*# National Aeronautics and Space Administration, Washington, D. C.
THE ACHIEVEMENT OF SPACE: VALUES AND DIRECTIONS
Robert C. Seamans, Jr. 15 Mar. 1966 31 p 1st Ann. Dr. Robert H. Goddard Lecture of the Natl. Space Club
(NASA-TM-X-57527) CFSTI: HC $2.00/MF $0.50 CSCL 05A

The pivotal concept that has guided NASA administration is defined by Dr. Robert C. Seamans, Jr., NASA Deputy Administrator, as the relation of the research and development project ot the many rapidly growing disciplines of science and technology. Project planning is discussed from this context, and the interrelationships of manpower requirements, the scheduled advances from concept, to design, to test, and actual operation; and program management are delineated. It is emphasized that a project team must operate within the agency's across-the-board management structure; that detailed regulations control the procurement cycle; that resource requirement estimates must be developed according to agency operating plan and budget procedures; and that status reports must be prepared in standard formats. Six representative project problems are cited as representative examples of the kind of experience from which useful management generalizations can be drawn. The involvement of the university–industry–government team in the research and development effort is stressed, and the potential applications of space achievements to nonspace use is discussed.

M.G.J.

N66-28603# United Aircraft Corp., East Hartford, Conn. Research Labs.

TWO-VEHICLE STOPOVER WITH RENDEZVOUS

R. V. Ragsac Feb. 1965 49 p refs

(D-110058-16)

An analysis is presented of a manned stopover mission to Mars employing two vehicles: a stopover vehicle which transfers the stopover crew from Earth to an orbit about Mars, and a manned pickup spacecraft which rendezvous at Mars to return the stopover crew to Earth. Using the total mass required on Earth parking orbit as a basis, comparisons are shown between this two-vehicle mode and the "standard" single-vehicle stopover. A discussion of the operational considerations related to the concept is presented. A detailed explanation is also given of the technique employed in minimizing the two-vehicle mass requirements. Solid core nuclear and chemical (O_2/H_2) Earth departure propulsion systems are evaluated for their effect on vehicle mass. The results show that for a chemical (O_2/H_2) Earth-escape propulsion system, no significant saving in mass is available regardless of the type of pickup trajectory used. For a nuclear escape system, the mass requirements of the two-vehicle system may be as much as 35% less than the single-vehicle case provided an increased mission duration of about 100 days may be tolerated. It appears that there are no unique advantages in the two-vehicle concept, other than that mentioned for the nuclear system. Author

N66-28606# Advisory Group for Aeronautical Research and Development, Paris (France).

OBSERVATIONAL ASPECTS OF GALACTIC STRUCTURE

A. Blaauw (Kapteyn Astronomical Lab.) and L. N. Mavridis (Acad. of Athens) 1965 399 p refs Lecture Notes from Internat. Summer Course held under Auspices of NATO Sci. Comm., Lagonissi, Greece, 9-23 Sep. 1964

CFSTI: HC $7.00/MF $2.00

Lecture notes on galactic research are presented, emphasizing large scale structure and motions, local structure, dynamics of the galaxy, stellar evolution, observational data, and future research. For individual titles see N66-28607–N66-28633.

N66-28607# Observatoire de Marseille (France).

POSSIBILITIES AND LIMITS OF OBSERVATIONS WITH LARGE TELESCOPES [POSSIBILITES ET LIMITES DES OBSERVATIONS AVEC DE GRANDS TELESCOPES]

Ch. Fehrenbach *In* AGARD Observational Aspects of Galactic Structure 1965 14 p In FRENCH (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Characteristics and sites for large telescopes are investigated, and both spectrographic and photographic possibilities and limitations are discussed. Both classical and electronic photography are considered, and observations of weak stars and night sky are discussed. Stellar and nebular spectrography are described, and the influence of atmospheric turbulence on observations is emphasized.

Transl. by M.W.R.

N66-28608# Observatoire de Marseille (France).

THE DETERMINATION OF RADIAL VELOCITIES; PROBLEMS AND PROGRAMS [LA DETERMINATION DES VITESSES RADIALES; PROBLEMES ET PROGRAMMES]

Ch. Fehrenbach *In* AGARD Observational Aspects of Galactic Structure 1965 19 p In FRENCH (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

The three methods currently used to measure radial velocity are examined, namely spectrography, photographic prisms, and interferometry. In discussing spectrographic observations, precision and quality of measurements are mentioned along with the distribution of various stellar spectra and the counting of clusters. Spectrographic measurements are considered very successful; their only drawback being in the size of the telescope required for such observations. The classical prism lens is discussed in terms of dispersion, distortion, and elementary theory; and modifications of this prism are described. Interferometry is considered best for the measurement of radial speed of gas nebula, and variations of Fabry techniques are described. Various galactic studies which require radial speed measurements are mentioned, including those dealing with so-called near stars, stellar fields, and interstellar materials.

Transl. by M.W.R.

N66-28609# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).

THE 80-INCH KARL SCHWARZCHILD TELESCOPE

H. Kienle *In* AGARD Observational Aspects of Galactic Structure 1965 9 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Optics and tube fork mounting, as well as design details, are discussed for the 80-inch Karl Schwarzschild telescope which is operable in three variants: Schmidt camera, quasi-Cassegrain, and Coude system. Excellent optical and mechanical properties are reported for this universal-type telescope at Tautenberg on the basis of three years of operation. For the Schmidt system the best light concentration occurs in the visual wavelength region for which the corrector plate was figured; and it is assumed that similar optical performance would be obtained for all wavelength regions >360 mμ. The light scattering diagram for the Coude arrangement indicates highly desirable performance, whereas Cassegrain operation requires improvements.

M.W.R.

N66-28610# Royal Observatory, Cape Town (South Africa).

SYSTEMS AND CATALOGUES OF PROPER MOTIONS

R. H. Stoy *In* AGARD Observational Aspects of Galactic Structure 1965 7 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

The use of extragalactic nebulae as a fixed background for approximating the annual angular motion of a star is discussed, as is the use of faint, and presumably more distant, stars. The latter requires that absolute proper motions be determined by the application of statistical correction to account for the relative motion of the background stars. The Luyten survey of 130,000 stars with appreciable proper motion is mentioned in terms of available catalogs. Important by-products of such a survey are the determination of the local luminosity function for faint stars and the discovery of objects such as white dwarfs and other stars of extremely low luminosity. Difficulties encountered in proper motion determinations and schemes for carrying out such determinations are mentioned. M.W.R.

N66-28611# Royal Observatory, Cape Town (South Africa).
CURRENT PHOTOMETRIC SYSTEMS
R. H. Stoy *In* AGARD Observational Aspects of Galactic Structure 1965 8 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

The development of photometric systems for the study of stars is discussed from a historical point of view, and methods currently in use are reviewed. Mention is made of two-color and multicolor techniques, and photoelectric improvements are considered. Difficulties involved in the photometry of faint stars are mentioned in the discussion following the report, as is the importance of red and infrared photometry. M.W.R.

N66-28612# Institute for Advanced Study, Princeton, N. J.
NARROW-BAND PHOTOMETRY AND ITS APPLICATIONS
B. Stroemgren *In* AGARD Observational Aspects of Galactic Structure 1965 15 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Selection of criteria for narrow band photometry is considered and available observation techniques and necessary calibrations are discussed in terms of the development of quantitative classification schemes. Separate discussions are included for the following spectral types: (1) B stars, (2) A2 to G2 stars, and (3) G8 to K3 stars. It is pointed out that if scatter is found which is considerably larger than can be accounted for, representativeness of a two-dimensional system should be questioned. The inclusion of chemical composition, rotation, magnetic field, or other parameters should be considered, particularly in narrow band photometry. In the case of B stars, particular attention must be given to the effect of hydrogen emission lines. Other parameters, such as metal abundance, are important factors in the classification of late F and G stars; and a chemical composition index permits a segregation of Hyades-type and M67-type G to K III stars. M.W.R.

N66-28613# Toronto Univ. (Ontario). David Dunlap Observatory.
THE CALIBRATION OF LUMINOSITY CRITERIA
Th. Schmidt-Kaler *In* AGARD Observational Aspects of Galactic Structure 1965 9 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Various methods of distance determination are discussed in relation to luminosity calibration for the classification of stars. Considered are dynamic, secular, stream, and trigonometric parallaxes; galactic rotation; cluster diameters; and tie-in methods to link photometric measurement with one of the above. The special case designated as the period-luminosity law for Cepheids is mentioned. Bias due to (1) random errors in the geometric distance determination and (2) cosmic dispersion and accidental errors in the measured criteria are discussed; and bandwidth effects and regional variations in the interstellar absorption law are considered. Examples of luminosity calibration reviewed for various stellar groups are: (1) K-line reversal width, (2) Balmer line intensities, (3) the Paris classification which uses measures of Balmer jump, the practical limit of the Balmer series, and the spectrophotometric gradient in the blue-violet corrected for reddening; (4) narrowband photometry and microphotometer tracings; (5) multivariate analysis; and (6) main sequence fitting which uses the Hyades for the basic zero point. M.W.R.

N66-28614# Mount Stromlo Observatory, Canberra (Australia).
SPACE DISTRIBUTION AND STATE OF MOTION OF THE COMMON STARS
B. J. Bok *In* AGARD Observational Aspects of Galactic Structure 1965 18 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Solar motion, mean parallaxes and absolute magnitudes, luminosity functions, and space densities are considered in a report dealing with common stars. Determination of solar motion from radial velocities and from proper motions is discussed; and luminosity functions for separate spectral-luminosity classes, the use of Malmquist's corrections, and the general luminosity function are considered. The two basic methods for determining stellar densities are outlined; and consideration is given to the distribution of stars near the galactic plane and at high altitudes. M.W.R.

N66-28615# Toronto Univ. (Ontario). David Dunlap Observatory.
SPACE DISTRIBUTION OF EARLY-TYPE STARS, OPEN CLUSTERS AND ASSOCIATIONS
Th. Schmidt-Kaler *In* AGARD Observational Aspects of Galactic Structure 1965 9 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Methods for finding the spiral features of the space distribution of stars are discussed in terms of position and one of the following: direction, distance, intensity, and velocity. Various conditions which are required for accurate measurements are outlined, and individual spiral tracers and their structure in the local domain are discussed for (1) early type open clusters, (2) OB-aggregates, (3) HII regions, (4) 32 Bpe stars, (5) Cepheids of highest luminosity, and (6) dark cloud complexes. The construction of charts depicting interstellar reddening near the galactic plane is considered, and it is noted that interstellar absorption must be carefully studied in this regard. It is concluded that within the local domain the spiral filaments formed by young stars, gas, and dust seem to coincide spatially and kinematically except for the regions with diameters of about 100 pc. This conclusion is based upon (1) direct comparison of the frequency function of the radial velocities of the stars and the 21 cm-profiles and (2) comparison of the Milky Way surface intensity distribution with the number of HI atoms along the Milky Way as a function of longitude. M.W.R.

N66-28616# Hamburger Sternwarte (West Germany).
RESEARCHES BASED ON OPEN CLUSTERS
H. Haffner *In* AGARD Observational Aspects of Galactic Structure 1965 14 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Catalogs, classification, and researches on open star clusters are considered in terms of contributions to knowledge of the galactic structure. Trigonometric parallaxes to measure changes in stellar position against the background

of distant stars are discussed, data on proper motions are reviewed, and stream motion in the Hyades is considered. Details are presented for researches dealing with photometric and spectroscopic studies of open clusters. M.W.R.

N66-28617# Kapteyn Astronomical Lab., Groningen (Netherlands).
SPACE DISTRIBUTION AND MOTIONS OF VARIOUS TYPES OF VARIABLE STARS
L. Plaut *In* AGARD Observational Aspects of Galactic Structure 1965 13 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

In order to provide data on the galactic structure, research studies are reviewed which deal with the space distribution and motions of the following variable stars: (1) Cepheids, (2) RR Lyrae, (3) W Virginis, and (4) RV Tauri. Long-period variables and their absolute magnitudes are also discussed. Velocity distributions and density gradients are tabulated for the different types of variables, and this permits a classification of these stars by population type. M.W.R.

N66-28618# Padua Univ. (Italy). Astrophysical Observatory.
SOME PROBLEMS CONCERNING GLOBULAR CLUSTERS
L. Rosino *In* AGARD Observational Aspects of Galactic Structure 1965 15 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Various definitions of globular clusters are considered, and attention is given to the work of Baade who defined a globular cluster as a stellar system with a spheroidal shape and central concentration, a diameter of from 10 to 200 pc, and a stellar population II. This definition proposes that all globular clusters of our galaxy are stable systems more than five billion years old; but other research indicates that age is not a unique parameter and such a definition must be regarded cautiously. Distance determinations, space distributions, motions, diameters, absolute magnitudes, masses, densities, and spectra are discussed; and the structure of globular clusters is considered. Variable stars found in such clusters are investigated, including their discovery, determination of apparent magnitudes and period and light curves, and specular variations of periods. The relationship of metallic content to clusters with variables is discussed; and age is considered to be an important factor in the richness or scarcity of variables as well as in the period distribution of differences between globular clusters. M.W.R.

N66-28619# Academy of Athens (Greece). Research and Computing Center.
INFRARED SURVEYS AND THEIR RESULTS
L. N. Mavridis *In* AGARD Observational Aspects of Galactic Structure 1965 31 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Surveys of red stars which have been carried out with the aid of objective prism low dispersion infrared spectra are reviewed, and criteria used and spectral classifications made are described. Various bands, used in the spectral classification of M, C, and S stars, discussed are the telluric, TiO, CN, LaO, and VO; and criteria used in the spectral classification of these stars are outlined. Surveys of the galactic belt and other regions are reported; and this section includes discussions of (1) bias affecting results of galactic belt surveys; (2) absolute magnitudes and intrinsic colors of M, C, and S stars; (3) deep surveys in selected regions of the Milky Way; and (4) open star cluster surveys. It is concluded that while many studies have been made of the relatively cool M, C, and S stars, the photometry of these stars has not reached a satisfactory level. To achieve this, the main problem lies in the establishment of accurate photoelectric sequences that also contain magnitudes corresponding to the red and infrared spectra. M.W.R.

N66-28620# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).
SURFACE BRIGHTNESS ANALYSIS OF THE MILKY WAY
H. Elsaesser *In* AGARD Observational Aspects of Galactic Structure 1965 16 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Star counts and direct photometry to determine the surface brightness distribution of the Milky Way are considered in terms of galactic structure studies. An isophotal map depicting brightness distribution over the Milky Way indicates that the distribution cannot be explained entirely by the structure within the two or three kpc region from the sun, and that brightness is affected by the large-scale structure of the galaxy. Contributing factors to the brightness distribution are: (1) stars of the galactic disk which are a mixture of population I and II, (2) spiral arm stars in the galactic plane which are young population I stars, and (3) interstellar absorption. The absorption and surface brightness are evaluated, and numerous graphs plot preliminary results obtained. M.W.R.

N66-28621# Landessternwarte auf dem Koenigstuhl, Heidelberg, (West Germany).
INTERSTELLAR MATTER; EXTINCTION AND POLARIZATION MEASUREMENTS
H. Elsaesser *In* AGARD Observational Aspects of Galactic Structure 1965 14 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Interstellar extinction and polarization measurements are made to determine (1) the influence of photometric distances in deducing the spatial distribution of stars and (2) interstellar dust grains as space probes of galactic structure. The problem of reddening and extinction is discussed; and determination of the reddening curve and correction for interstellar extinction are considered. Absorption is derived as a function of distance and cloudiness of the absorbing matter. Methods of measuring interstellar polarization are described, and the nature of interstellar particles is discussed. M.W.R.

N66-28622# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
RADIO-ASTRONOMICAL MEASUREMENTS; ACCURACIES AND PROBLEMS
F. J. Kerr *In* AGARD Observational Aspects of Galactic Structure 1965 4 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

A general discussion is directed to students of optical astronomy to give them some understanding of problems related to radio measurements. Among the special topics considered are the measurement of wavelength/frequency, position, brightness distribution and flux density, spectra, and polarization. M.W.R.

N66-28623# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
RADIO-ASTRONOMICAL OBSERVATIONS OF GALACTIC STRUCTURE
F. J. Kerr *In* AGARD Observational Aspects of Galactic Structure 1965 15 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Studies of continuum radiation and neutral hydrogen line emission are discussed in terms of radio astronomical observations of the galactic structure. Despite the importance

of continuum radiation, it is noted that observations of the spectral line of atomic hydrogen have resulted in the most information about the galaxy because they can be used to measure radical velocities from the Doppler shifts which, in the galaxy, are largely due to differential motions in a cloud. Differential galactic motion is a prime cause of this, and details are presented for various studies dealing with the rotation curve. Spiral arms and other large-scale structures are discussed as are the thickness of the layer of neutral hydrogen and total amount of surrounding hydrogen. It is pointed out that there is no substantial component of neutral hydrogen in the galactic halo, but rather a very low component which would be hard to separate from zero-load intensity. Cloud temperature is also discussed. M.W.R.

N66-28624# Leiden Univ. Observatory (Netherlands).
THE CENTRAL REGIONS OF THE GALAXY
J. H. Oort *In* AGARD Observational Aspects of Galactic Structure 1965 8 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Both an overall picture and details of the various parts of the central part of the galaxy are presented. An inspection of a catalog of 21-cm line profiles indicates that near the galactic center, $|l^{II}| < 20°$, are extended and very low "wings" on either of the sides of the main emission. The profiles between $l^{II} = -23°$ to $+5°$ also exhibit a secondary maximum known as the 3-kpc arm. There is considered to be observational evidence for assuming the existence of a disk of gas with a radius of about 800 pc around the central galaxy, and that this nuclear disk is rotating about 200 km/sec at the periphery. Line profiles indicate matter with positive radial velocities, and there are abrupt differences in velocity field for points close together which are difficult to understand. Observations of the central regions are difficult to interpret because of the intermingling of radiation from near and far gas clouds. Irregularities observed in the disk, especially in the OH absorption spectrum, are considered to indicate expansional motions, for which possible causes are (1) magnetic fields, (2) non-axisymmetric gravitational fields, or (3) a super-supernova explosion millions of years ago. M.W.R.

N66-28625# Mount Wilson Observatory, Pasadena, Calif.
THE MASS DISTRIBUTION IN THE GALAXY; DETERMINATION OF BASIC QUANTITIES
M. Schmidt *In* AGARD Observational Aspects of Galactic Structure 1965 16 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Techniques for the construction of models to determine mass distribution in the galaxy are discussed; and basic quantities required are determined on the assumptions that the interstellar gas has an average motion that is circular and that the 21-cm rotation curve for the northern hemisphere represents circular velocities in a steady, axisymmetric, gravitational potential field. Inhomogeneous spheroids are generally used in model construction; and procedures for computation of mass distribution are given, as is a means for detecting the difference between rotational and circular velocities of the interstellar gas. Details are included for determining (1) rotation constants, (2) distance from center, (3) ratio between axes in the direction of center and of motion, (4) radial velocity, (5) density gradient, and (6) circular velocity. Adopted values of rotation constants, A and B, and our position in the galaxy, R_0, are discussed; and these are given as 15 km sec^{-1}/kpc, -10 km sec^{-1}/kpc, and 10 kpc, respectively. Based on these values, a simple model is described which is considered satisfactory as a first approximation to mass distribution in the galaxy. M.W.R.

N66-28626# Leiden Univ. Observatory (Netherlands).
SOME PROBLEMS IN GALACTIC DYNAMICS
J. H. Oort *In* AGARD Observational Aspects of Galactic Structure 1965 8 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Determination of the force perpendicular to the galactic plane, causes for spiral structures, and dynamics of halo populations are considered. Initial stages in the formation of the galaxy are discussed with the assumption that all of the galactic components were formed from a large contracting gas cloud. The stars formed early in the collapse, which have orbits characteristic of the gas motion at that time and very low metal content, make up the halo population. Newer stars formed as the gas continued to collapse may be contaminated with metals. An equation for the conservation of energy of the cloud is given. M.W.R.

N66-28627# Institut d'Astrophysique, Paris (France).
STELLAR ABUNDANCES FROM WIDELY DISPERSED SPECTRA: RESULTS [ABONDANCES STELLAIRES A PARTIR DES SPECTRES A GRANDE DISPERSION: RESULTATS]
G. Cayrel-de Strobel *In* AGARD Observational Aspects of Galactic Structure 1965 24 p refs In FRENCH (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Nuclear processes in the galaxy and their applications to astrophysics and particularly, to the study of the chemical composition of the stars are considered in a review of studies carried out during the last several years. It is concluded that the chemical composition varies with the nuclear reactions inside the stars; and a listing of the most important processes, their productions, and temperatures in the star centers is included. It is noted that Population II stars are deficient in metallic content because they were formed when the galaxy consisted only of hydrogen. Methods for the study of chemical composition are detailed. Transl. by M.W.R.

N66-28628# Observatoire de Paris (France). Section d'Astrophysique.
INTRINSIC QUALITIES ASSOCIATED WITH THE CHEMICAL COMPOSITION OF STARS [PROPRIETES INTRINSEQUES LIEES A LA COMPOSITION CHIMIQUE DES ETOILES]
R. Cayrel *In* AGARD Observational Aspects of Galactic Structure 1965 5 p refs In FRENCH (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Comparison of the chemical composition and the kinematic properties of stellar material gives evidence of the age of the galaxy. An estimate of about 15×10^9 years with a velocity distribution of 42 km/s appears to agree with the speeds for some old stars but is much less than that for stars deficient in metallic halos. Conclusions based on information previously reported indicate small velocity dispersions for stars O and B, and that dispersion is great for stars of an advanced spectral type. Supergiants and Cepheid variables are like O and B stars, and there is wider dispersion for sub-dwarf stars. Kinematic properties of RR Lyrae are less extreme than those of sub-dwarfs. Transl. by M.W.R.

N66-28629# Observatoire de Paris (France). Section d'Astrophysique.
CORRELATION BETWEEN KINEMATIC QUALITIES AND INTRINSIC QUALITIES OF STARS [CORRELATION ENTRE PROPRIETES CINEMATIQUES ET PROPRIETES INTRINSEQUES DES ETOILES]

R. Cayrel *In* AGARD Observational Aspects of Galactic Structure 1965 6 p refs In FRENCH (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Visual classification of the intrinsic properties of stars is discussed, along with photometric and other indices which permit the groupings. A review of recent literature is made to examine briefly the relationship of these intrinsic properties to kinematic properties for more than 200 stars. Certain questions remain unanswered, such as how does one explain the intense nuclear activity during the first 10^8 years of the galaxy's existence? Transl. by M.W.R.

N66-28630# Mount Wilson Observatory, Pasadena, Calif.
EVOLUTION IN THE GALAXY
M. Schmidt *In* AGARD Observational Aspects of Galactic Structure 1965 6 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

A model, proposed to determine evolutionary patterns of stars in the galaxy, assumes that the rate of star formation depends on the mass of gas actually present in the neighborhood of the solar system. A conservation equation is written for the gas mass at a certain time which assumes that the solar neighborhood is in itself a closed system with no inflow or outflow of matter. The mass used in star formation is given by a formula; and as far as ejected mass is concerned, the assumption is made that the star ejects all its mass except what is needed to become a white dwarf. Initial and final conditions for the model are specified. Other information needed for the model can be derived from a comparison of the present formation rates of bright and faint stars as well as by the metal content of interstellar space. M.W.R.

N66-28631# Mount Stromlo Observatory, Canberra (Australia).
THE MAGELLANIC CLOUDS: A SELECTIVE SURVEY OF SOME PROBLEMS—WITH SPECIAL REFERENCE TO THE LARGE MAGELLANIC CLOUD
B. J. Bok *In* AGARD Observational Aspects of Galactic Structure 1965 9 p refs (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

General properties are listed for both the small and large Magellanic clouds; and distance, velocity, and other related problems are discussed. It is reported that RR Lyrae variables provide the most direct evidence for the distance modulus of the large cloud, and that the Cepheid variables note discrepancies between the period-luminosity relations in the large and small clouds. Color-magnitude arrays of older clusters are mentioned. In discussing the velocity problem, studies are reviewed which deal with the optical radial velocities of stars and emission nebulas, objective prism radial velocities, and other data. Young associations in the large cloud are considered, including the Shapley Constellation I which is one of the most spectacular and clearly defined. Mass of associated gas and evolutionary status are discussed for this constellation which has no counterparts in the Milky Way. The two southern clusters of associations which most resemble Constellation I are MGC 6231 in Scorpio and IC 2944 in Centaurus. M.W.R.

N66-28632# Mount Stromlo Observatory, Canberra (Australia).
DESIDERATA FOR FUTURE GALACTIC RESEARCH
B. J. Bok *In* AGARD Observational Aspects of Galactic Structure 1965 21 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

In pointing the direction for future studies in galactic structure, basic observational needs are cited in the areas of positional astronomy, wideband and narrowband photometry, spectral luminosity classification, measurement of radial velocities, 20-cm radio research, and unmanned and manned space investigations. Other areas which require concerted research are the nearby stars, interstellar space, the galactic center, and spiral structure and the velocity law. Possibilities for studies include luminosity functions and calibration of absolute magnitude criteria, mass distribution near the sun, and kinematical properties and chemical composition; as well as interstellar absorption, emission and dark nebulas, and rate of star formation. M.W.R.

N66-28633# Institute for Advanced Study, Princeton, N. J.
GALACTIC RESEARCH PROJECTS FOR SATELLITE OBSERVATORIES
B. Stroemgren *In* AGARD Observational Aspects of Galactic Structure 1965 11 p (See N66-28606 16-30) CFSTI: HC $7.00/MF $2.00

Space-based observatories offer the advantages of nearly perfect "seeing" as well as an improvement of the order of two magnitudes in the background radiation level and an extension of observations into the far ultraviolet and infrared, soft X-ray, and long radio wave regions. Galactic research which could be accomplished by satellites includes mapping of the entire sky by scanning, photometry of single objects, observations of interstellar grains and gas, statistical sampling of stars, and astrometric work with an orbiting large aperture, reflecting telescope. M.W.R.

N66-28655*# Ewen Knight Corp., East Natick, Mass.
RADIO OBSERVATIONS OF THE MOON AND VENUS AT 8.6 mm WAVELENGTH Final Report, May 1, 1962–Nov. 1, 1965
[1965] 136 p refs
(Contract NASw-593)
(NASA-CR-75313) CFSTI: HC $4.00/MF $1.00 CSCL 03B

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N66-28656*# Ewen Knight Corp., East Natick, Mass.
THERMAL RADIATION FROM THE MOON AT 8.6 mm WAVELENGTH
In its Radio Observations of the Moon and Venus at 8.6 mm Wavelength [1965] 33 p refs (See N66-28655 16-30) CFSTI: HC $4.00/MF $1.00

Observations of the moon, with an angular resolution of 4×5-1/2 minutes of arc, were made at 8.6 mm wavelength during the one-year period from August, 1963 through August, 1964. By means of a raster scan technique, antenna temperatures as functions of local phase angle were obtained for four selected regions of the lunar surface. The data were

corrected for radome attenuation, which was measured directly and daily corrections calculated from ground level meteorological data were made for the effects of atmospheric attenuation. The temperature versus phase angle curves were corrected for antenna smoothing before being examined from the standpoint of both one and two layer models. Although the absolute temperatures and phase angles are subject to some uncertainty, the data are generally inconsistent with the homogeneous model for the lunar surface, but agrees with what would be expected from a layered structure. Author

N66-28657*# Ewen Knight Corp., East Natick, Mass.
A TWO-LAYER MODEL OF THE LUNAR SURFACE
In its Radio Observations of the Moon and Venus at 8.6 mm Wavelength [1965] 13 p refs (See N66-28655 16-30) CFSTI: HC $4.00/MF $1.00

A two layer model of the lunar surface is treated theoretically and an exact analytical solution is obtained for the microwave brightness temperature in terms of the periodic surface temperature. It is found that the time average of the microwave temperature is, even after correction for surface reflectivity, less than the time average of the surface temperature. Further, if the surface layer can be assumed sensibly transparent, the phase lag of maximum microwave temperature behind full moon can be any value whatsoever depending on the thickness of the layer. Author

N66-28658*# Ewen Knight Corp., East Natick, Mass.
OBSERVATIONS OF VENUS NEAR THE 1962 INFERIOR CONJUNCTION
In its Radio Observations of the Moon and Venus at 8.6 mm Wavelength [1965] 7 p refs (See N66-28655 16-30) CFSTI: HC $4.00/MF $1.00

Radio observations of the planet Venus in the millimeter wavelength region were reported and the conflicting results obtained were discussed. Following the inferior conjunction of 1962, observations were made at 8.6 mm wavelength with a 28-foot, randome-enclosed, equatorially mounted paraboloid. The brightness temperature of Venus as a function of the fraction of the planetary disk illuminated by the sun is presented graphically. Typical drift curves of Venus showing the 5°K calibrating signal is depicted. A table lists the number of drift curves, the mean antenna temperature, and the mean brightness temperature. The standard deviations resulting from the least squares analysis were 10°K for the intercept and 120°K for the slope. R.LI.

N66-28659*# Ewen Knight Corp., East Natick, Mass.
OBSERVATIONS OF VENUS NEAR THE 1964 INFERIOR CONJUNCTION
In its Radio Observations of the Moon and Venus at 8.6 mm Wavelength [1965] 10 p refs (See N66-28655 16-30) CFSTI: HC $4.00/MF $1.00

The purpose of the observations was to determine the average disk microwave brightness temperature as a function of planetary phase angle. But, the reduced data were found to contain anomalous variations larger than would be expected from phase alone, so that a reliable measure of brightness temperature could not be made. It was noticed, however, that the variations seemed to correlate with solar activity. D.T.

N66-28660*# Ewen Knight Corp., East Natick, Mass.
ATMOSPHERIC EFFECTS ON CELESTIAL RADIO MEASUREMENTS AT 8.6 MILLIMETERS
Paul M. Kalaghan *In its* Radio Observations of the Moon and Venus at 8.6 mm Wavelength [1965] 33 p refs (See N66-28655 16-30) CFSTI: HC $3.00/MF $1.00

Engineering information on methods of observation and instrument limitation is presented. Areas of consideration include: (1) methods for establishing the focal plane of the secondary reflector; (2) techniques for the cancellation of the atmospheric reradiation component; (3) the effect of the atmosphere in the near field of the antenna aperture (far field approximately 12 miles); (4) determination of antenna beam position; (5) calibration of indicated versus actual radio beam position; (6) attenuation and reradiation attributable to atmospheric gases and associated condensation and precipitation products; and (7) measurement errors introduced by the radome under various observational conditions. A series of measurements were performed to determine the probable magnitude of the error introduced as a result of atmospheric attenuation. Based on these measurements, it was found that the methods of observation and data reduction used in the lunar measurements reduced the effect of atmospheric errors to a negligible degree. D.T.

N66-28713# Hittman Associates, Inc., Baltimore, Md.
THE DEVELOPMENT OF A DYNAMIC THREE DIMENSIONAL ATMOSPHERIC MODEL FOR USE IN THE STUDY OF THE SELECTIVITY OF ORBITAL DECAY (TASK III)
Albuquerque, N. Mex., Sandia Corp., Jul. 1965 79 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-65-1701) CFSTI: HC $3.00/MF $0.75

A number of atmospheric models were evaluated for use in the study of the selectivity of orbital decay. It was found that only Anderson's model indicates the variation of density with latitude. A computer program MODEL was written to facilitate the use of this model. The program was used to calculate the density of the atmosphere as a function of several parameters for an altitude range of 90 to 800 km. 137 references. NSA

N66-28766*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONTRIBUTIONS OF MSC PERSONNEL TO THE MANNED LUNAR EXPLORATION SYMPOSIUM
[1964] 95 p ref Presented at the Manned Lunar Exploration Symp., NASA Manned Spacecraft Center, Houston, Tex., 15–16 Jun. 1964
(NASA-TM-X-57578) CFSTI: HC $3.00/MF $0.75 CSCL 22A

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N66-28767*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO MISSION DESCRIPTION

William A. Lee *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 1–10 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

A typical lunar landing mission is described which provides a total duration of about eight days and a 24-hour stay on the lunar surface. Earth launch and lunar landing phases are described, along with the return lunar launch and earth landing. Translunar trajectories are planned to vary between 62 and 75 hours, whereas return trajectories may range from 85 to 115 hours. The lunar landing area accessible to the Apollo spacecraft is assumed to be a rectangle 90° wide and 10° high, centered on the near-earth face of the moon; but specific landing sites within this area have not been selected. Two crew members will land on the moon, while one member remains in orbit. Numerous illustrations depict the various phases of the proposed mission. M.W.R.

N66-28770*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR SURFACE ACTIVITIES

Curtis C. Mason and Elbert A. King, Jr. *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 31–39 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

Four separate excursions are outlined for a typical mission that might provide up to 35 hours stay time on the lunar surface, and a listing is presented of the instruments and tools desirable for these short missions away from the lunar spacecraft. Geological, surveying, and recording instruments; aids to communication, navigation, and cartography; sample collection; and photography on the lunar surface are discussed. M.W.R.

N66-28773*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

MSC RESEARCH ON LUNAR SURFACE EXPERIMENTS

John E. Dornbach *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 53–63 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

Attention is given to the determination of optimum measurements, experiments, and geologic studies to be made on the lunar surface as well as experimental equipment development and mission support studies. Among the equipment considered are a lunar surface exploration camera, a long-life meteoroid detector–analyzer, an X-ray diffractometer, a solar proton monitor, and a mass spectrometer. Lunar surface simulation models, astronaut training in selenology and geosciences, and power and telemetry studies are mentioned. This overview of lunar surface experiments is discussed in terms of in-house and contracted research projects which are underway or proposed. M.W.R.

N66-28774*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR ORBITAL EXPLORATION

James H. Sasser *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 65–70 (See N66-28766 16-30) CFSTI:: HC $3.00/MF $0.75

Mapping of lunar surfaces and obtaining data on the origin and evolution of the moon are considered in terms of a lunar orbital survey mission. Studies preparatory to and during such a mission are considered in a general review. Various researches underway are mentioned, including: (1) ultraviolet spectroscopy to investigate the feasibility of lunar compositional mapping; (2) photometric, polarimetric, thermal, and dielectric properties of suggested lunar surface materials, and (3) infrared sensors and multispectral photography for lunar compositional analyses. M.W.R.

N66-28776*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR ATMOSPHERIC MEASUREMENTS

Dallas E. Evans *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 79–85 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

Previous experimental results and theoretical considerations dealing with lunar atmospheric measurements are briefly reviewed; and maximum lunar atmospheric densities obtained by various authors as well as properties of theoretical lunar atmospheres from various models are tabulated. The use of mass or optical spectrometric techniques is discussed for the following phases of an Apollo mission: translunar, lunar orbit, transearth, and lunar surface. Potential problems due to outgassing of the Lunar Excursion Module (LEM), various experimental packages, or emission from the LEM retrorocket may be avoided by placing the spectrometer far enough away from the LEM. M.W.R

N66-28801*# Maryland Univ., College Park. Dept. of Chemistry.

THERMODYNAMIC EQUILIBRIA IN PLANETARY ATMOSPHERES

Ellis R. Lippincott, Richard V. Eck, Margaret O. Dayhoff (Natl. Biomed. Res. Found.), and Carl Sagan (Harvard Univ.) *In* Natl. Biomed. Res. Found. Invest. of Thermodyn. Mech. for the Production of Complex Compds. Essent. for the Origin of Life [1966] 34 p refs (See N66-28800 16-04) CFSTI: HC $4.00/MF $1.00

From present information on the composition, pressures, and temperatures of planetary atmospheres, we have calculated the expected thermodynamic equilibrium composition of the atmospheres of the Earth, Venus, Mars, and Jupiter. Departures from thermodynamic equilibrium must be attributed to special mechanisms, including, on the Earth, biological activity. The major constituents of the terrestrial atmosphere are found to be in approximate thermodynamic equilibrium; while many minor constituents have abundances exceeding their equilibrium values, there is a marked tendency for equilibrium to be restored. It appears that the atmosphere of Venus is in thermodynamic equilibrium, while that of Jupiter is not. The evidence for Mars is less conclusive, although not inconsistent with thermodynamic equilibrium. For none of these planets is there a molecular species with a large predicted equilibrium abundance and spectroscopically accessible absorption features which has not been already identified. The predicted equilibrium abundances of oxides of nitrogen are extremely low on all planets. Author

N66-28818# Royal Aircraft Establishment, Farnborough (England).

SATELLITE MOTION IN AN AXI-SYMMETRIC FIELD, WITH AN APPLICATION TO LUNI-SOLAR PERTURBATIONS

R. H. Gooding Jan. 1966 129 p refs
(RAE-TR-66018) CFSTI: HC $4.00/MF $1.00

The disturbing function for an axi-symmetric potential field is expanded into a doubly infinite Legendre harmonic series. The effect of the general harmonic term on the motion of a satellite in the field is developed by averaging with respect to the mean anomaly of the satellite and applying Lagrange's planetary equations. Expressions for the variation of orbital elements due to the main harmonics are listed, the results being applicable to the perturbations of an earth satellite due to asphericity of the earth and luni-solar influence. General expressions for secular and long-period perturbations are obtained. Author

N66-28903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROIDS: NEEDS FOR PENETRATION SCALING LAWS AND THE POTENTIALS OF SIMULATION TECHNIQUES
E. T. Kruszewski *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1964] 36 p refs (See N66-28899 16-11) CFSTI: HC $4.00/MF $1.00

A summary is presented of state of the art in predicting the penetration of semi-infinite targets by particles traveling at meteoroid velocities. Several accurate solutions have been made by treating the penetration as a hydrodynamic phenomenon, but uncertainties in the equation of state and the cratering criteria have caused large differences in the resultant scaling laws. It was concluded that existing devices are capable of simulating meteoroid impacts only in the lower velocity range. Empirical and theoretical scaling laws are discussed for these low-velocity impacts; and meteoroid velocity impacts and simulation techniques are considered, along with accelerators for both armor penetration and meteoroid simulation. It was concluded that uncertainties in predicted penetration in the high meteoroid velocity range are on the order of one magnitude. M.W.R.

N66-28908# Air Force Cambridge Research Labs., Bedford, Mass.
OBSERVATIONS OF THE ATMOSPHERIC SCINTILLATION OF RADIO STAR AND SATELLITE SIGNALS
J. Aarons, R. Allen, H. Whitney, and L. Katz *In* Comision Nacl. de Invest. Espaciales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 14 p ref (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

Ionospheric and tropospheric irregularities, as determined by fluctuations in radio star and satellite signals, were investigated. Two parabolic antennas, one equatorially mounted and one altitude-azimuth mounted, were used for cosmic radio sources. The amplitude variations, resulting from the earth's rotation, source motion, and irregularity motions, were recorded. Graphed data are presented on ionospheric and tropospheric scintillations and their scintillation rate, mean scintillation index as a function of elevation, quiet periods, diurnal variations, and variations with geomagnetic latitude and local magnetic activity. Satellite analysis established the association with the region of precipitation, both by latitude distribution and by response to solar-geomagnetic activity. A phenomenological model to describe the features of the outer particle regions was found to fit the geographical distribution and geomagnetic control characteristics of radio wave scintillation. It is also found that the diurnal behavior of the radio wave scintillation does not fit the behavior of the particle flux. Interpretations of the recorded measurements are discussed. N.E.N.

N66-28912# Comisseo Nacional de Atividades Especiais, Sao Jose Dos Campos (Brazil).
DIFFERENTIAL FARADAY MEASUREMENT OF ELECTRON CONTENT WITH THE S-66 SATELLITE
F. de Mendonca and J. L. R. Muzzio *In* Comision Nacl. de Invest. Espaciales Proc. of the Regional Symp. of the Intern. Years of the Quiet Sun, Vol. II 1965 8 p refs (See N66-28907 16-29) CFSTI: HC $3.00/MF $0.75

The simplicity of a method for determining the total ionospheric electron content I, when Faraday rotation measurements are available for two closely spaced frequencies transmitted from a satellite, was demonstrated. The data used was from the polar beacon ionosphere satellite S-66, launched on 19 March 1964. Expressions are developed for the velocity and position of the satellite relative to the initial conditions. The differential Faraday rotation data are shown. An equation for the electron I is then presented, based on the probable trajectory and the Faraday rotation measurements, and the value of I was determined to be 1.07×10^{17} elec/m^2. It was considered that this value, from the probable trajectory, was close to the average value of I calculated from differential Doppler measurements with other satellites for the same time. N.E.N.

N66-29066*# National Aeronautics and Space Administration, Washington, D. C.
A REPORT FROM MARINER IV
[1965] 8 p
(NASA Facts, Vol. III, No. 3) GPO: $0.10 CSCL 22A

A narrative account is presented on the achievements of Mariner IV. This nontechnical report discusses the photographic coverage of Mars, and assesses the observations drawn from the data which were obtained. Findings indicate: (1) the surface pressure of the Martian atmosphere is lower than 10 millibars, as compared to the approximately 1000 millibars of actual sea level pressure on earth. (2) No change in magnetic forces or radiation intensities was detected. (3) No significant increase in micrometeoroids nears Mars was reported. (4) Intergalactic radiation was found to be higher. Some details are also included on Mars-Earth picture transmission, the Deep Space Network operation, and the data processing facilities. M.G.J.

N66-29198# Texas Univ., Austin. Dept. of Astronomy.
A SPECTROPHOTOMETRIC ANALYSIS OF PROCYON Final Report
Frank N. Edmonds, Jr. Apr. 1966 7 p refs
(Grant Nonr(G)-00049-64)
(AD-631697) CFSTI: HC $1.10/MF $0.50

This report presents brief summaries of the work completed or in progress on two technical reports being prepared for the project. They concern hydrogen line stark broadening functions, and a weak line fine analysis abundance determination. R.N.A.

N66-29236# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TABLE OF HARTREE-FOCK SELF CONSISTENT FIELD WAVE FUNCTIONS WITH EXCHANGE, SUPPLEMENT I
T. K. Krueger, W. L. Mc David, and S. J. Czyzak Jan. 1966 484 p refs
(ARL-66-0014; AD-631938) CFSTI: HC $7.85/MF $2.25

A table is presented of the Hartree-Fock wave functions for various atoms and ions mainly of astrophysical interest having atomic numbers up to 28. Also included in the table

are the one-electron energy parameters and the relativistic and spin-orbit energy corrections. Author (TAB)

N66-29298*# Stanford Univ., Calif. Radioscience Lab.
THE STANFORD STUDY OF THE MARINER IV OCCULTATION DATA Semiannual Report No. 3, 1 Oct. 1965–31 Mar. 1966
V. R. Eshleman Jun. 1966 3 p
(Grant NGR-05-020-065)
(NASA-CR-75816) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The large difference in atmospheric surface pressure (actually more than 50%) between the occultation levels at Electris and Mare Acidalium is reported as the most interesting result derived from the analysis of the Mariner IV–Mars occultation experiment and the Martian atmosphere experimental models. Both the higher pressure and the smaller radius determined at Mare Acidalium suggest that this region is at a lower gravitational level than the bright Electris area. Analyzed data indicated that some of the haze and particle layers observed with earth-based telescopes and with the Mariner IV television camera may have been CO_2 particles. R.Ll.

N66-29322# Royal Aircraft Establishment, Farnborough (England).
ORBITAL PARAMETERS OF STAR-RAD (1962 βK) FOR 19TH SEPTEMBER TO 6TH OCTOBER 1965
R. J. Tayler Mar. 1966 19 p refs
(RAE-TR-66102) CFSTI: HC $1.00/MF $0.50

196 observations of the satellite STAR-RAD have been used to determine its orbit at intervals of 25 nodes between 19 September and 6 October 1965. The work has been done as a supplement to a previous determination of this satellite's orbit for the years 1962 to 1964. Author

N66-29343*# George Washington Univ., Washington, D. C.
COMMUNIST CHINA AND SPACE
Harold C. Hinton Dec. 1964 11 p refs *Its* PPSST Note No. 2
(Grant NsG-727)
(NASA-CR-57455) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The brief paper presents an interpretation of the main considerations that might lead Communist China to inaugurate an active program of space exploration and of the fragmentary available unclassified evidence suggesting that it does in fact intend to launch such a program. The paper is not based on special research and is intended merely as an indication of what might be done by way of further work on this subject. Author

N66-29348*# National Aeronautics and Space Administration, Washington, D. C.
VELOCITY AND ENERGY OF THE TUNGUS METEORITE [O SKOROSTI I ENERGII TUNGUSSKOGO METEORITA]
K. P. Stanyukovich and V. A. Bronshten Nov. 1961 8 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 140, no. 3, 1961 p 583–586
(NASA-TT-F-8174) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This article examines the possible mechanisms which caused the Tungusk meteorite explosion. The more probable explanation is that the meteorite core was a dense cluster of small bodies. As the meteorite entered the earth's atmosphere, the cluster was surrounded by a general shock wave. However, as it penetrated the lower atmosphere, its density decreased because of mass difference and its transverse dimensions and length increase. As a result each separate body or groups of bodies with a nearly similar mass had individual shock waves. The destruction process of the bodies ceased prior to their reaching the ground, while the shock waves caused the observed destructions and the radiation of the powerful shock waves caused the radiant burns on the trees. R.N.A.

N66-29372*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REVIEW OF LUNAR AND PLANETARY MAGNETIC FIELD MEASUREMENTS USING SPACE PROBES
Edward J. Smith [1965] 37 p refs Submitted for Publication
(Contract NAS7-100)
(NASA-CR-67604) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Data obtained from space probes carried out near the moon (by Lunik II), near Venus (by Mariner II), and near Mars (by Mariner IV) are interpreted for determining the planetary field interactions with the ionized interplanetary medium (the solar wind), and for deriving the boundaries of the magnetic fields. Magnetic dipole measurements made near the earth by various space probes and satellites are also used to aid in the empirical interpretation; and methods of plasma physics are applied. Not only the data obtained, but the spacecraft trajectories and even some of the instrument characteristics are considered. Diagrams of the magnetic fields around the Earth, moon, Venus, and Mars (based on the magnetic dipole strength data), and showing the upper and lower bounds of the fields, are given. L.S.

N66-29394*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
EXPLORATION OF INTERPLANETARY SPACE BY UNMANNED VEHICLES
Paul C. Dow, Jr. [1965] 33 p refs Presented at the 5th European Space Flight Symp., Munich, 19–22 Jul. 1965 Prepared in part for JPL
(Contracts NASw-697; JPL-950896)
(NASA-CR-64803) CFSTI: HC $2.00/MF $0.50 CSCL 22A

Scientific objectives of the interplanetary space exploration program are discussed in light of achievements by the Mariner spacecrafts and goals of Voyager. High-priority measurements to be made by an orbiter or flyby and landing capsule are listed for the future Mars mission. Landing site selection is examined in terms of constraints imposed by physical aspects, nature of the trajectory, and use of a dual purpose orbiter–lander vehicle. A typical mission profile is presented; and factors influencing selection of launch date, trajectory, and orbit or flyby path are indicated. A split-mission spacecraft consisting of an orbiter and lander is shown to be the most advantageous for early missions. Spacecraft orientation, communication systems, reliability, and sterilization are briefly summarized. Design problems and concepts are considered for capsules, landers, and spacecraft. S.P.

N66-29396*# National Aeronautics and Space Administration, Washington, D. C.
PLANETARY SPECTRA [SPEKTRY PLANET]
May 1964 16 p refs Transl. into ENGLISH from Prirody (Moscow), no. 6, Jun. 1961 p 39–45
(NASA-TT-F-888) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The analysis of data gathered from the earth by the spectral method of investigation is discussed briefly. It is pointed out that spectroscopic investigations of the planets have developed in three principal directions: study of planetary rotation on the basis of the Doppler shift of spectra lines, photometric study of the continuous spectrum of planets as well as the search for new lines and absorption bands, and study of

already known lines and bands. Reports on the results of these investigations are presented in greater detail. A survey of research on the following topics is presented: auroras, and carbon dioxide and water vapor in the Venusian atmosphere; vegetation on Mars; hydrogen and its compounds in the atmospheres of the giant planets; the meteoric nature of Saturn's rings; luminescence and lunar surface color; and the minor planets' spectra. R.L.I.

N66-29402# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
SOLAR RADIO FLUX DURING THE IQSY AT UNIVERSITY PARK, PENNA., OCTOBER–NOVEMBER–DECEMBER 1965
John P. Hagen May 1966 32 p
(Grant NSF GP-2986)
(SR-004)

Tabulations are presented on solar radio flux data recorded at 10,700, 2700, and 328 Mc/sec by the Radio Astronomy Observatory (40° 50' N, 77° 53' W). The observed data were tabulated for 3-hour periods: 1200 to 1500 UT, 1500 to 1800 UT, 1800 to 2100 UT, and 2100 to 2400 UT. Daily averages of the 3-hour averages are given and are corrected to one A.U. The data are grouped according to month; within each month, they are grouped according to frequency with the observed data preceding those corrected to one A.U. The equatorial mount, radiometers, and data reduction procedures are discussed, and observations of distinct events are listed. L.E.W.

N66-29405*# National Aeronautics and Space Administration, Washington, D. C.
PROGRESS AND PROBLEMS IN ATMOSPHERE ENTRY
Alfred J. Eggers, Jr. and Nathaniel B. Cohen [1965] 72 p refs Presented at the 16th IAF Intern. Congr., Athens, 13–18 Sep. 1965
(NASA-TM-X-56855) CFSTI: HC $3.00/MF $0.75 CSCL 22C

Problems of entry vehicle motion, heating, and heat protection are discussed in the context of current and possible future space flight missions, including unmanned probes of the atmospheres of Mars, Venus, and Jupiter, and manned vehicles appropriate for controlled planetary entry at velocities from orbital to hyperbolic. Problems in reentry physics such as transition to turbulent flow, turbulent heat transfer at hyper-velocities, and complex radiation flow-field interactions and their possible influence on vehicle configuration are discussed. Attention is also given to ground simulation facilities, such as the expansion tunnel, ballistic shock tunnel, and high enthalpy arc jet. Finally, some consideration is given to the comparative features of rocket braking and maneuvering. Author

N66-29410*# Cambridge Univ. (England).
A RADICAL DEPARTURE FROM THE "STEADY STATE" CONCEPT IN COSMOLOGY
F. Hoyle and J. V. Narlikar [1965] 29 p refs Submitted for Publication Prepared jointly with Calif. Inst. of Tech.
(Grant NGR-05-002-028; Contract Nonr-220(47))
(NASA-CR-67871) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The results in this paper are based on an entirely different choice of the undetermined coupling constant f which appears in the theory of creation of matter. Previously f was chosen to make the steady state expansion rate coincident with the observed expansion rate. Taking a much larger value for f, the corresponding steady state expansion rate is much greater than the observed value. This difference is interpreted as showing that we live in a wide, possibly temporary, fluctuation from the steady state situation. The expansion rate in such a fluctuation follows the Einstein-de Sitter relations. The natural scale set by the new steady state corresponds to the masses of clusters of galaxies, obtaining 10^{13} $M_{\odot}$ instead of 10^{23} $M_{\odot}$ for the observable universe. It is suggested that elliptical galaxies were formed early in the development of a fluctuation. The discussion of high energy phenomena leads to immediate explanations of the energy spectrum of cosmic rays, of the presence of e+ in cosmic rays, and of the rate of energy production associated with radio sources. Author

N66-29411*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A THEORY OF THE ORIGIN AND EVOLUTION OF CONTACT BINARIES
Su-Shu Huang [1965] 29 p refs Submitted for Publication
(NASA-TM-X-56745) CFSTI: HC $2.00/MF $0.50 CSCL 03B

It is proposed here that the orbital angular momentum of binaries may be dissipated through mass ejection along magnetic lines of force. It brings the separation of two component stars closer and closer, such that in some cases contact binaries, like W UMa systems, may be formed in this way. If the dissipation of angular momentum continues after the two components come into direct contact, the course open for the binary is to transfer mass from the less massive to the more massive component. Three observational results are discussed (1) the mass ratios of the W UMa systems, (2) the negative correlation between the axial rotation and the frequency occurrence of spectroscopic binaries in different clusters and associations, and (3) the stars of hydrogen-poor and helium-rich atmospheres. Finally, a general scheme of interrelationship among stellar objects is advanced according to the consideration of angular momentum. Author

N66-29433*# National Aeronautics and Space Administration, Washington, D. C.
SPECTROPHOTOMETRIC STUDY OF THE INTENSIFICATION OF THE 5577 Å LINE IN ZODIACAL LIGHT [SPEKTROFOTOMETRICHESKOYE ISSLEDOVANIYE USILENIYA LINII 5577 Å V ZODIAKAL'NOM SVETE]
Z. V. Karyagina Nov. 1963 16 p refs Transl. into ENGLISH from Izv. Astrofiz. Inst. Akad. Nauk Kaz. SSR, v. 5, no. 7, 1957 p 110–119
(NASA-TT-F-8702) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The comparison is made of integral brightness of the 5577 Å line of the nightglow for the axis of the Zodiacal light, and for two points of the sky on the same zenith distance (70°). Angular distances from the sun were 40° to 60°. Integral brightness was obtained with a spectrograph, having a high focal ratio of 1:0.7, by integrating the tracing and subtracting the intensity of the continuous spectrum. Mean enhancement of 12% to 17% of the 5577 Å line of the Zodiacal light, was observed. A suggestion of a possible variability of the enhancement is made. Author

N66-29456*# National Aeronautics and Space Administration, Washington, D. C.
QUALITATIVE ANALYSIS OF FORMS OF MOTION IN THE PROBLEM OF THE MOTION OF AN ARTIFICIAL SATELLITE IN THE NORMAL GRAVITATIONAL FIELD OF THE EARTH [KACHESTVENNYY ANALIZ FORM DVIZHENIYA V ZADACHE O DVIZHENII ISKUSTVENNOGO SPUTNIKA
Ye. P. Aksenov, Ye. A. Grebenikov, and V. G. Demin Oct. 1963 73 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 16, 1963 p 173–197
(NASA-TT-F-8513) CFSTI: HC $3.00/MF $0.75 CSCL 22C

The forms of motion of an artificial satellite in the earth's gravitational field are treated, and satellite motion is formulated in generalized elliptical coordinates (determined from the first integrals of motion equations) μ, λ, w, in relation to rectangular coordinates. All forms of motion in the problem studied are classified according to values for h: for $h>0$, the motion is elliptical; for $h<0$, the motion is hyperbolic; and for $h=0$, the motion is parabolic. Motions occurring on trajectories that pass even partially outside of the earth's surface are termed real motions; a quadrature is presented defining the elliptic coordinate λ, a criterion for the existence of real motions. In connection with these real motions, satellite motions, or those which take place on restricted trajectories lying entirely outside the earth's surface, as well as ballistic trajectories, lying partially inside the earth, are described by mathematical functions. R.Li.

N66-29456*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NATURE OF THE SPACE ENVIRONMENT

John C. Evvard [1965] 37 p Presented at 8th Ann. Missile and Space Tech. Inst., Storrs, Conn., 5 Aug. 1965
(NASA-TM-X-56741) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The phenomena of solar space and the solar system are examined in relation to the probabilities of cosmic rays, solar winds, lethal radiations associated with solar flares, and the occurrence of magnetic storms. Equations for estimating the atmospheric composition are derived, and the variations in composition with altitude are discussed. The dependence of radio transmission on sky wave refraction is assessed, and the use of passive and active communication satellites as communication system links is explored. The origin of air glow is related to the view the astronauts see from the orbiting spacecraft, and the necessary illumination criteria for visual observation of earth are defined. Factors governing the thermal environment, and the effects of the magnetic field on the near-earth space environment are delineated. Satellite data on the Van Allen belts are presented, and the problems connected with meteoroid flux and penetration are considered. Planetary environments for manned exploration are also discussed. M.G.J.

N66-29494# Royal Aircraft Establishment, Farnborough (England).

OPTIMUM CLIMB PATHS FOR BALLISTIC MISSILES AND SATELLITE LAUNCHING VEHICLES

G. B. Longden Feb. 1966 78 p refs
(RAE-TR-66035) CFSTI: HC $3.00/MF $0.75

This report collects and restates past work on the best climb path for a ballistic missile or satellite launching vehicle. The solution for the general climb through the atmosphere over a spherical earth is stated in the form of seven simultaneous first-order differential equations. The optimum attitude of the missile at each point is that which maximizes the component of the impressed forces in a certain direction called the critical direction. This critical direction coincides with the guidance critical direction at cut-off. Before cut-off, three of the differential equations are mainly concerned with solving for the critical direction. For a satellite launching vehicle in a vacuum, the optimizing criterion reduces to a single differential equation for the rate of change of the critical direction. Author

N66-29515*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

SPECTRAL SHIFTS IN QUASI-STELLAR OBJECTS

Peter D. Noerdlinger, J. R. Jokipii, and L. Woltjer (Columbia Univ.) [1966] 18 p refs
(Grants NsG-96-60; NsG-179-61; Contract AF 49(638)-1358) (NASA-CR-75945; EFINS-66-56) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The hypothesis that quasi-stellar objects have been ejected with relativistic velocities from many comparatively nearby galaxies is considered. The expected frequency distribution of blueshifts and redshifts is calculated. If all members of a given group of objects with similar velocities could be observed, redshifts would be more numerous than blueshifts, but because the blueshifted objects are much brighter, they can be seen at much larger distances. If the groups are created at random through a Euclidean portion of space and a sample brighter than some limiting magnitude is examined, blueshifts should be far more numerous than redshifts. This appears contrary to observation. Author

N66-29522*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

THE SPECTRAL SHIFTS OF AN ENSEMBLE OF RELATIVISTIC EMITTERS

Peter D. Noerdlinger and J. R. Tokipii [1966] 14 p refs
(Grants NsG-96-60; NsG-179-61)
(NASA-CR-75829; EFINS-66-51) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A Doppler shift toward the red is found for the radiation from most members of an ensemble of relativistically moving emitters. This effect would make it difficult to observe blue shifts from quasars if they are relatively nearby objects in highly relativistic motion. Author

N66-29529# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut für Steuer- und Regeltechnik.

A REPRESENTATION OF TRAJECTORY AND VELOCITY COORDINATES FOR SPACE FLIGHT BY A GENERALIZED KEPLER-APPROXIMATION AND CORRECTIONS IN THE ITERATION PROCEDURE [EINE DARSTELLUNG FUER BAHN- UND GESCHWINDIGKEITSKOORDINATEN IN DER RAUMFAHRT DURCH EINE VERALLGEMEINERTE KEPLER-NAEHERUNG UND KORREKTUREN IM ITERATIONSVERFAHREN]

Werner Bollermann Mar. 1966 56 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-08; DVL-490)

Superposition of Keplerian movements of a space vehicle around each planet is used to derive an expression which renders the trajectory coordinates highly accurate for limited time intervals. By this method any initial value problem of orbit computation can be solved with the help of perturbation theory. In some standard cases closed approximate solutions for the n-body problem of space flight including additional thrust can be obtained. Author

N66-29563# Martin Co., Denver, Colo.

AN ANALYTICAL APPROACH TO THE ESCAPE PROBLEM FOR LARGE THRUST VEHICLES

Maurice L. Anthony [1964] 48 p refs

A vehicle escaping from a circular orbit about a planet is considered. The thrust used is large but finite, the residual speed at infinity is a prescribed quantity, and the thrust direction program is given as one of five functions of time and coordinates. By means of a change of the independent variable, a small parameter is introduced in the nonlinear equations of motion. For a constant thrust acceleration, an approximate analytical solution of the initial value problem is

obtained for each thrust direction program using the method of expansion, often called the perturbation method, in a small parameter. The thrust direction programs considered are (a) circumferential thrust, (b) thrust in the optimal constant direction relative to local circumferential direction, (c) tangential thrust, (d) thrust in a direction offset from tangential by an angle proportional to the time to cutoff, and (e) thrust in a direction offset from tangential by an angle proportional to the square of the time to cutoff. It is found that, in the order listed, each thrust direction program is more economical on fuel than all the earlier programs. In addition, by examining numerical results, it is found that the optimal thrust direction program (in the sense of the calculus of variations) requires only slightly less fuel than offset tangent programs. Author

N66-29643*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

MISSION PLANNING

Wyendell B. Evans, Howard W. Tindall, Helmut A. Kuehnel, and Alfred A. Bishop *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 157-167 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Mission planning activities for the Gemini program evolved from Project Mercury planning techniques and can be categorized by the following four basic phases: (1) mission design requirements; (2) design reference missions; (3) operational mission plans for each flight; and (4) real-time mission planning for specific flights. Orbital attitude and maneuver systems, the inertial guidance system, and the fuel-cell power system in the Gemini spacecraft were considered in the overall planning. Resulting philosophies, mission-design requirements, and constraints can be included in Apollo and future space programs. G.G.

N66-29645*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

FLIGHT CONTROL OPERATIONS

John D. Hodge and Jones W. Roach *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 179-187 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Flight control is defined as the necessary integration between the flight crew and ground control personnel to accomplish manned space flights successfully. It is that portion of mission control pertaining primarily to the aspects of vehicle dynamics, orbital mechanics, vehicle systems operations, and flight crew performance. The mission planning is traced briefly from preliminary design, through updating, to the final plan. The experience gained from the Mercury program in Gemini mission planning is mentioned. The logic of flight control decisions is diagramed, and significant mission control operations activities illustrating several flight control techniques are presented. These illustrations are from Gemini III-VII flights, and cover orders for correcting failures, orbital activities at the control center and the remote sites are indicated. The several areas in which experience has been gained from flights through Gemini VII are identified. N.E.N.

N66-29653*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

GEMINI VI-A RENDEZVOUS MISSION PLANNING

Edgar C. Lineberry *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 277-281 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

This paper discusses the mission planning effort for the Gemini VI-A mission which applied directly to rendezvous. Included are a discussion of the basic design criteria and a brief history of the considerations which led to the selection of the particular Gemini VI-A mission plan. A comparison between the nominal and actual flight trajectories is also presented. Author

N66-29656*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

GEOASTRONOMICAL OBSERVATIONS

Franklin E. Roach (Environ. Sci. Serv. Admin.), Lawrence Kunkelman, Jocelyn R. Gill, and Robert D. Mercer *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 315-323 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Visual geoastronomical observations by the astronauts aboard the Mercury and Gemini orbital series of flights are discussed. Information on star sightings during both daytime and nighttime is presented; and observations of airflow bands surrounding the earth, of the aurora australis, and of meteors are discussed. A table of meteors observed during the Gemini flights; a map of the auroral zone surrounding the earth; a sketch of the auroral arc (as drawn by Gemini VII crewmen); some photographs of the horizon zone surrounding earth; and some parameter curves (relating to vision) are included with the discussions of the observations. L.S.

N66-29660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROTATIONAL MOTION OF AN ARTIFICIAL SATELLITE ON ELLIPTICAL ORBIT

M. S. Volkov 30 Mar. 1966 17 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Inst. Teor. Astron. (Leningrad), v. 9, no. 4, 1963 p 274-282

(FTD-TT-65-1557/1+4; AD-631566) CFSTI: HC $1.60/MF $0.50

The paper deals with the integration of differential equations of rotational motion of an artificial satellite on elliptical orbit. The solution has been constructed in the form of the series of $\sigma = 3/4\ n/L_0 \cdot A-C/A$, where n—the mean motion of the satellite on the orbit, L—precessional rotation velocity of the satellite, A, C—moments of inertia of the satellite with dynamical symmetry. Author (TAB)

N66-29661*# National Aeronautics and Space Administration, Washington, D. C.

SPECTROPHOTOMETRIC INVESTIGATION OF THE MECHANISM OF THE EXCITATION OF FILAMENTARY NEBULAS [SPEKTROFOTOMETRICHESKOYE ISSLEDOVANIYE MEKHANIZMA VOSBUZHDENIYA VOLOKNISTYKH TUMANNOSTEY]

S. B. Pikel'ner Jul. 1966 49 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 12, 1954 p 93-118

(NASA-TT-F-8790) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The spectra of the filamentary nebulas NGS 6960-6992 were obtained using a nebular spectrograph. The relative intensities of basic lines in four regions of the nebula are given. It is stated that the spectrum is characterized by a low degree of ionization by forbidden lines which are intensive with respect to H_β. An examination was made into the nonstationary processes upon the passage of a wave through nonionized interstellar gas; the density increases and the kinetic temperature of heavy particles behind the wave front were established. Calculations were made which yielded the condition of the ionization of oxygen, sulfur, and nitrogen for

various distances from the front. It is reported that the calculated spectrum roughly agrees with the observations. To explain the density of the filamentary form, it is hypothesized that two waves intersect. The first wave causes partial ionization and compression of the gas; the second enters the cold but ionized and compressed gas. The calculations for the relative brightness are discussed and compared to actual observations. H.S.W.

N66-29709*# Illinois Univ., Urbana. Coordinated Science Laboratory.
AERODYNAMIC TORQUE ON A SPINNING SPHERICAL SATELLITE WITH APPLICATION TO MEASUREMENT OF ACCOMMODATION COEFFICIENTS
Gerald R. Karr May 1966 60 p refs
(Grant NsG-443; Contract DA-28-043-AMC-00073(E))
(NASA-CR-75983; R-295) CFSTI: HC $3.00/MF $0.50 CSCL 22A

This analysis consisted of first obtaining the aerodynamic torque equations for a spinning spherical satellite and finding the motion of the spin axis due to this torque. The torque was found to depend upon the accommodation coefficient of the satellite surface and the orientation of the satellite with respect to the orbital plane. Consideration was therefore given to the effects of nonuniform accommodation coefficient distribution and time dependent satellite orientation. The former was analyzed by considering nonuniform heating of the satellite surface which was assumed to cause a nonuniform distribution of accommodation coefficient. The effect of time dependent orientation of the satellite was analyzed by including orbital regression effects which cause a change in the orientation of the satellite with respect to the orbital plane. The results of all the calculations were applied to the satellite proposed by the Coordinated Science Laboratory to measure a general relativity effect. Author

N66-29732*# RAND Corp., Santa Monica, Calif.
RADIATIVE-CONVECTIVE EQUILIBRIUM CALCULATIONS FOR A TWO-LAYER MARS ATMOSPHERE
C. B. Leovy May 1966 55 p refs
(Contract NASr-21(07))
(NASA-CR-75633; RM-5017-NASA) CFSTI: HC $3.00/MF $0.50 CSCL 03B

Preliminary to a numerical experiment in simulating the circulation of the Mars atmosphere, a computer model that simulates diurnal and seasonal variation in ground and atmospheric temperatures on Mars was constructed; it incorporates the effects of radiation, small-scale turbulent convection, and conduction into the ground. All calculations are based on an atmosphere having a surface pressure of 5 mb and composed entirely of CO_2, as indicated by the Mariner 4 occultation experiment. Adjustable parameters in the model include: the thermometric conductivity of the ground, and the rate of turbulent heat exchange between ground and atmosphere. The model is calibrated by adjusting these constants so that observations of a portion of the diurnal variation in ground temperature are well simulated. An interesting result of the calculations is the prediction of an ice cap composed of solid CO_2 whose maximum extent corresponds with that of the observed Martian polar cap. Some possible implications of the computed temperature distributions are also considered, along with space probe experiments that could be made to verify, reject, or improve the model. A simplified model was devised to compute soil heat flux that depends on surface temperature variations rather than on ground temperatures. R.Ll.

N66-29736*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPROXIMATE SOLUTION OF THE EQUATIONS OF MOTION FOR ARBITRARY ROTATING SPACECRAFT
Peter Ralph Kurzhals (Ph.D. Thesis—Va. Polytech. Inst.) May 1966 244 p refs
(NASA-TM-X-57691) CFSTI: HC $6.00/MF $1.50 CSCL 22A

This dissertation comprises the development and application of an approximate analytical solution for the motion of arbitrary rotating spacecraft with variable disturbance functions. The solution is based on the assumptions of small changes in the spacecraft inertia characteristics, body rates, and Euler angles. The rate and attitude errors, resulting from the application of disturbance torques, are described by complex pseudovectors and the governing spacecraft equations are reduced to linear differential equations in terms of these error vectors. Solutions are obtained for the steady spinning mode and for a spinup and despin mode. Author

N66-29738*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR STUDIES OF THE MOON Quarterly Progress Report No. 2, 1 Feb.–30 Apr. 1966
2 Jun. 1966 57 p refs
(Contract NSR-22-009-106)
(NASA-CR-76012) CFSTI: HC $3.00/MF $0.50 CSCL 03A

Short pulse studies of the lunar surface were made at a 23-cm wavelength, and several conclusions were drawn about the behavior of the lunar surface as a scatterer of radio waves. By using different polarizations for transmission and reception, some of the depolarizing properties were explored. Results indicated that scattering from the center of the disk is largely from regions that are locally smooth on the scale of the wavelength, whereas for an angle of incidence $\phi > 40°$, scattering from rough structure appeared to predominate. Some of the theoretical material pertaining to the effect of shadowing on the backscattering from a rough surface is discussed, and it is concluded that recent theories based on the Kirckhoff theory are erroneous and tend to over-estimate the effect of shadowing. Block diagrams are given of the computer programs required for the Haystack 3.8-cm radar, which will provide radar maps of the lunar surface. Preparations for 8-mm observations were begun by reactivating a 28-ft parabolic antenna system. Determination of the depth of the upper layer of light material on the lunar surface by radio methods is also discussed. L.E.W.

N66-29813# American Meteorological Society, Boston, Mass.
EXPERIMENTAL SPECTROPHOTOMETRIC COMPARISON OF THE SURFACE OF THE MOON AND CERTAIN VOLCANIC DEPOSITS [OPYTY SPERTROFOTOMETRICHESKOGO SOPOSTAVLENIIA POVERKHNOSTI LUNY S NEKOTROYMI VULKANICHESKIMI POKROVAMI]
I. I. Lebedeva Bedford, Mass., AFCRL, Mar. 1966 9 p refs
Transl. into English from Uch. Zap. Leningr. Gos. Univ., Ser. Mat. Nauk (Leningrad), no. 326, 1965 p 99–102
(Contract AF 19(628)-3880)
(T-R-588; TT-66-61162; AD-631970) CFSTI: HC $1.00/MF $0.50

The published data on the spectral reflectivity of the lunar marina and continents are compared to corresponding data for diverse samples of terrestrial rocks from Kamchatka and Kuril Islands. These samples were studied with a photoelectric spectrophotometer (in the region 450–590 millimicron). The spectral reflectivity curves for lapilli, volcanic sand, and brown volcanic scoriae coincide with corresponding curves for the

lunar surface in the limits of natural dispersion. Therefore, one can conclude that the presence on the moon of the pyroclastic materials of the type mentioned is possible.
Author (TAB)

N66-28823# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SPACE PATHS OF THE VOSKHOD
T. Mel'kumov 19 Aug. 1965 7 p Transl. into ENGLISH from Voyennyye Znaniya (USSR), no. 12, 1964 p 3
(FTD-TT-65-659/1+2+4; TT-65-63849; AD-620806)
CFSTI: HC $1.00/MF $0.50

The success of the Soviet 3-man Voskhod space flight is discussed in terms of technical progress and compared with the U.S. Mercury missions. The advantages of a 3-man spacecrew, the Voskhod soft terrestrial landing, and the Gemini project are briefly mentioned. R.N.A.

N66-29862 California Inst. of Tech., Pasadena.
OBSERVATIONS OF THE OWENS VALLEY RADIO OBSERVATORY. I: THE GALACTIC SPURS AS A SINGLE FEATURE
G. W. Rougoor 1966 7 p refs
(Contract Nonr-220(19))
(AD-632345) CFSTI: HC $1.00/MF $0.50

The spurs, visible in maps of low frequency radio emission at intermediate and high galactic lattitudes, can be connected to form one single feature, passing close to the galactic poles and crossing the galactic plane under right angles. Because of its shape and its relation with the galactic system it is unlikely that the spurs are relatively close by and that they are remnants of supernovae. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-28552*# National Aeronautics and Space Administration, Washington, D. C.
PROJECT: GEMINI 9
10 May 1966 73 p
(NASA News Release-66-97) Available from the Scientific and Technical Information Division CSCL 22B

Background material is presented on the planned activities of the Gemeni 9 space flight. The preflight, flight, and reentry activities for astronauts and ground crew are described. The scientific and technological experiments and the instrumentation are discussed. The crew training and provisions are covered. The tracking network, and the spacecraft and launch vehicle descriptions are included. N.E.N.

N66-28712*# McDonnell Aircraft Corp., St. Louis, Mo.
CONTROL TECHNIQUES FOR LARGE LAUNCH VEHICLES Final Report, Jul. 1964-Sep. 1965
John Zaborszky and William J. Luedde 1 Sep. 1965 385 p refs Summary of this rept. published as NASA-CR-462; see N66-22362 11-32
(Contract NASS-11418)
(NASA-CR-75795; NASA-CR-462; B897) CFSTI: HC $7.00/MF $2.00 CSCL 22D

The major control problems, largely attributable to the flexibility of boosters which may result in significant oscillations at as many as four elastic modes in addition to three fuel slosh modes, are discussed. Two separate and largely independent sets of requirements, leading to two separate and independent digital solutions which may be applied individually or jointly, are described. These deal with (1) an angle-of-attack exceeding the structural strength, which may develop when the vehicle passes through extremely severe wind profiles, and (2) the low maximum frequency feasible with linear compensation for the rigid body response, due to the low frequency of the first bending mode. Studies of combinations of analytical work, hybrid simulation, and all-digital simulation are presented. Parameters of the study vehicles and the specifications for wind and gust environment are included. Details of the digital adaptive filter, the digital polynomial filter, and the digital drift minimum control are given. Extensive tables and graphs are included. N.E.N.

N66-28745*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1964 PROJECT REPORT: MISSION AND SPACECRAFT DEVELOPMENT. VOLUME I: FROM PROJECT INCEPTION THROUGH MIDCOURSE MANEUVER
1 Mar. 1965 771 p refs
(Contract NAS7-100)
(NASA-CR-75797; JPL-TR-32-740, Vol. 1) CFSTI: HC $14.00/MF $3.75 CSCL 22B

The formation and organization of the Mariner Mars 1964 Project is described and its development up through the time of the midcourse maneuver is traced. The development of the spacecraft itself is detailed, including design concepts and changes, fabrication and procurement history, and flight performance for the early portion of the flight. A schematic diagram depicts the spacecraft mechanical configuration; photographs and tabulations portray the spacecraft power, propulsion, temperature control, and telecommunications systems. Structural design is reported, and subsystems for radio, command, data encoder, central computer and sequencer, and video storage are detailed with the aid of graphs, charts and block diagrams. Scientific instrumentation, such as the cosmic dust detector, helium magnetometer, and narrow angle Mars gate, is assessed. Environmental and life tests, and spacecraft operational support equipment are discussed. R.LI.

N66-28766*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT DESCRIPTION
O. E. Maynard *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 11-20 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

The command, service, and lunar excursion modules of the lunar exploration spacecraft are described, along with the communication links between earth and modules. Some details on the operational subsystems are included; and launch escape system, adapter, and environmental control systems are discussed for the spacecraft configuration for the S-IVB stage of the Saturn V launch vehicle. M.W.R.

N66-28769*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT CAPABILITY FOR APOLLO SCIENTIFIC EXPERIMENTS
John Eggleston *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 21–29 (See N66-28768 16-30) CFSTI: HC $3.00/MF $0.75

Various types of experiments to be performed during ascent, on the lunar surface, and during the return to earth from a lunar exploration are discussed as are the containers and storage compartments for the necessary instrumentation. Most equipment will be carried in the Lunar Excursion Module descent stage, and passive experiments will be self-contained with power and telemetry. Weight and volume distribution of the equipment in the various modules and stages are given, schedules for experimental planning are mentioned, and typical environmental design criteria are listed for the scientific payload provisions. M.W.R.

N66-28775*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT CAPABILITY FOR LUNAR ORBITAL SURVEY
Donald Bresie and Rene A. Berglund *In its* Contrib. of MSC Personnel to the Manned Lunar Exploration Symp. [1964] p 71–78 (See N66-28766 16-30) CFSTI: HC $3.00/MF $0.75

The ability of the Apollo spacecraft to perform a lunar orbital survey mission is discussed, and a typical 14-day mission is presented. Suggested sensor systems such as high resolution cameras, electronic sensors, and surface probes are described; along with an equipment module. Author

N66-28839# Douglas Aircraft Co., Inc., Santa Monica, Calif.
FUTURE SPACE LAUNCH VEHICLES: EXPENDABLE OR RECOVERABLE?
Charles C. Kelber [1965] 49 p Presented at the 6th Intern. Symp. on Space Technol. and Sci., Tokyo, 1 Dec. 1965 *Its* Paper No. 3665

Two opposing philosophies for performance growth and cost reduction of large space launch vehicles are examined to determine preferred routes of technological development. It is concluded that within the next 10 years the cost effectiveness of expendable systems could be improved by nearly an order of magnitude (ten-fold) by vigorous pursuit of the large solid motor and high-energy propellant technologies coupled with serious efforts at design for minimum cost. The technologies requiring advancement for recoverable vehicles to be successfully competitive are investigated and described in terms of the most fruitful avenues for research and development, and definition of necessary accomplishment in terms of capability and schedule is given. It is concluded that recoverable space vehicles will evolve over a period of approximately 20 years; during the last half of this span of time, they will be economically competitive with, and finally superior to, expendable launch vehicles. Author

N66-29164# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPIN DECAY OF A CLASS OF SATELLITES CAUSED BY SOLAR RADIATION
B. Etkin and P. C. Hughes Jul. 1965 59 p refs
(Contract DRB PD-69-415014; Grant AF-AFOSR-222-64) (UTIAS-107; AD-631934) CFSTI: HC $3.00/MF $0.75

A study is presented of the interaction with the solar radiation field of a spinning satellite having long flexible rods. The dynamics of thermal bending of the rods is analyzed, including the effect of vehicle rotation, and the shape, amplitude and phase are calculated. The radiation pressure on the periodically bent rods produces a net average despin torque that depends critically on the phase lag of the thermal bending. The theory is compared with flight data from the Alouette I and S48 satellites, and the agreement indicates that the mechanism studied is the primary cause of despin of these vehicles. A means of preventing despin is proposed. It consists of polished plates mounted on the tips of the rods. The torque produced by the solar pressure acting on them is opposite to that on the rods. The plate area required for complete cancellation of the despin torque is of order 1/4 to 1/2 of the projected rod area. Author (TAB)

N66-29181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATION OUTSIDE THE EARTH
B. V. Lyapunov 27 Jan. 1966 168 p refs Transl. into ENGLISH of the book "Stantsiya Vne Zemli" Moscow, Voyennoye Izd. Min. Oborony USSR, 1963 p 1–147
(FTD-MT-64-531; AD-631585) CFSTI: HC $16.40/MF $1.00

Translation of a 1963 Russian publication on space stations, satellites, interplanetary routes, and their value for science and practical use. TAB

N66-29290*# General Dynamics/Convair, San Diego, Calif.
THE CENTER VENT SHAPE FOR VENTING A TANK IN A LOW GRAVITY ENVIRONMENT
C. K. Perkins 25 Jul. 1961 24 p ref
(NASA-CR-72006; GD/C-66-D-859) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Existing computations and liquid/liquid model tests have demonstrated the general zero-g equilibrium configuration of the Centaur upper-stage fuel-tank ullage. This report contains calculations and some discussion of the effect of the center-vent tube on this ullage-bubble configuration. The equilibrium shape about a two-inch tube is calculated. It appears that the liquid/gas interface will be displaced about 2.3 inches below the uppermost bubble surface. Because this effect is so small, it is concluded that, with certain restrictions, the simple center tube will make a practical vent. Author

N66-29301*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO SPACECRAFT BP-15. A CHRONOLOGY OF TECHNICAL PROGRESS AT KENNEDY SPACE CENTER
1 Aug. 1965 43 p
(NASA-TM-X-57679; SP-207) CFSTI: HC $2.00/MF $0.50 CSCL 22B

The technical progress for the Apollo boilerplate spacecraft BP-15 is chronicled from the arrival of the service and command modules and launch escape system tower, to the launch and one-hour flight report. Checkout procedures and mission objectives are listed, and the major tests performed are summarized. Equipment measurements indicated satisfactory performance in the launch environment. S.P.

N66-29306# Royal Aircraft Establishment, Farnborough (England).
ORBITAL PARAMETERS OF SAMOS 2 (1961 α 1), MAY-JULY 1961 AND MAY-JULY 1962

R. H. Merson and E. R. Neville Feb. 1966 19 p refs
(RAE-TR-66042) CFSTI: HC $1.00/MF $0.50

One thousand observations, mainly visual, of the satellite SAMOS 2 have been used to determine its orbit during three-monthly periods in 1961 and 1962. The satellite was only visible during 5% of each revolution, so that its orbital plane was not very accurately determined. The size (semi-major axis) and shape (eccentricity) of the orbit, however, were determined satisfactorily. The accuracy of individual observing stations has been assessed on the basis of declination, residuals and, in most cases, the station's own estimate is confirmed.

Author

N66-29339*# RAND Corp., Santa Monica, Calif.
A SUGGESTION FOR EXTENSION OF THE NASA RANGER PROJECT IN SUPPORT OF MANNED SPACE FLIGHT
R. C. Moore Dec. 1964 20 p refs
(NASr-21(09))
(NASA-CR-60466; RM-4353-NASA) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Once Rangers 8 and 9 have been launched, this project, after three frustrating but rewarding years, will be terminated. It is suggested that a production version of this vehicle could continue to serve the programs for lunar exploration, both manned and unmanned, as an operational tool as well as provide valuable scientific information about the moon. To discontinue the series is to lose the opportunity of providing relatively inexpensive support for the far more expensive Surveyor and Apollo projects.

Author

N66-29351*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPROACH IN ACHIEVING HIGH RELIABILITY OF THE SATURN CLASS VEHICLES
Eberhard Rees [1965] 20 p Presented at the 4th Ann. Reliability and Maintainability Conf., Los Angeles, 28–30 Jul. 1965
(NASA-TM-X-56766) CFSTI: HC $1.00/MF $0.50 CSCL 22D

A discussion is presented on reliability, and approaches used in achieving high reliability, for the Saturn family of vehicles. The conflict between theoretical and practical approaches is noted. The accepted approach involves the application of sound and knowledgeable engineering and engineering judgement, based on long range experience and supported by analytical tools such as a detailed analysis of each component and subsystem, logic diagrams, mathematical models, etc., followed by an exhaustive qualification test program, system test program, and a quality assurance program. Some examples of this reliability approach to various hardware groups and systems are given. The paper concludes that the inherent reliability of a launch vehicle is as good as its design and engineering. Technical difficulties in all reliability programs are almost always found in subsystems and components. When funds must be reduced, the last thing to be cut down on should be test facilities and equipment and the volume of testing. However, flight hardware should not be over-inspected or over-tested. If an unexpected and irregular function occurs during testing or checkout of a component or stage, and does not occur again in a repeat test, it shoud not be ignored.

R.N.A.

N66-29363*# Consultants and Designers, Inc., Arlington, Va.
THE COSMIC SYSTEM "ELECTRON". NEW ACHIEVEMENTS OF SOVIET SCIENCE IN MASTERING THE COSMOS
S. N. Vernov, G. A. Skuridin, and Yu. L. Logacher 10 Apr. 1964 14 p refs Transl. into ENGLISH from Pravda (Moscow), no. 75, 15 Mar. 1964 p 3
(Contract NAS5-2078)
(NASA-TT-F2-6681; ST-PR-10123) CFSTI: HC $1.00/MF $0.50 CSCL 22B

This article discusses the orbits of the Electron I and Electron II satellites, which sweep the earth's radiation belts, the upper atmosphere, and the circumterrestrial space; and describes their operation and instrumentation.

R.N.A.

N66-29382*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY INVESTIGATIONS OF THE RECOVERY OF A LARGE BOOSTER BY MEANS OF AERODYNAMIC DECELERATORS AND A HOT-AIR BALLOON
Stanley H. Scher [1965] 28 p refs Presented at the Course in Final Phase Aerodyn. Deceleration at Minn. Univ., Minneapolis, 12 Jul. 1965
(NASA-TM-X-56797) CFSTI: HC $2.00/MF $0.50 CSCL 22D

Feasibility studies of a hot-air balloon recovery system for large boosters are described. Some system performance factors deceleration, aerodynamic heating, and weight were analytically investigated; and an experimental study was conducted to see whether the balloon can be deployed and inflated with ram air entering its mouth. Two means of using the hot-air balloon for providing buoyancy in the lower atmosphere (with a subsequent dry recovery) were analytically explored. The two systems are illustrated. In the first system, called the balloon-alone system, a single large balloon is used both as the decelerator for reentry and as the buoyant device. In this case the balloon must be able to withstand the aerodynamic heating on reentry. The other system, called the decelerator plus balloon system, uses smaller decelerators for the reentry phase and a large nonheat-protected balloon deployed at relatively low velocities for buoyancy in the lower atmosphere. The results of the studies indicate that the hot-air balloon recovery system shows sufficient promise to justify continued work on other problem areas of such a system. Other charts, diagrams, and tables of data relating to the system study are also given.

L.S.

N66-29406*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STATUS OF RELIABILITY ASSESSMENT FOR UNMANNED SATELLITES
William W. Wolman [1965] 15 p refs Presented at the 11th Natl. Symp. on Reliability and Quality Control, Miami Beach, Fla., 13 Jan. 1965; and at the Am. Soc. for Quality Control, Cumberland Sect., 2d Western Md. All-Day Quality Control Conf., Cumberland, Md., 18 Oct. 1965
(NASA-TM-X-56754) CFSTI: HC $1.00/MF $0.50 CSCL 14D

Reliability assessment techniques applied to unmanned space systems now have been in effect for about five years and it is useful to review the methodology used, its effectiveness, and usefulness. The review encompasses the approach and methodology and a comparison of the assessment results prior to space flight with actual flight results. Major problem areas are the development of adequate mathematical models; the availability of information to estimate system, subsystem, component and part failure rates; the use of correction factors to compensate for the space environment; and the proper interpretation of assessment results. The performance of assessments before actual flight is discussed from the veiwpoint of establishing a plausible hypothesis which is subject to acceptance or rejection by the flight program.

The question of interpreting a situation where assessment results show a relatively unreliable system but later flight results show success or the opposite is examined in the framework of scientific and rational models. Author

N66-29470*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRONIC PERFORMANCE OF THE S-52 FLIGHT 1 SPACECRAFT UNDER THERMAL-VACUUM EXPOSURE
Nathan Mandell and Harry W. Leverone 26 Oct. 1964 108 p (NASA-TM-X-55167; I-320-64-158) CFSTI: HC $4.00/MF $0.75 CSCL 22B

A summary of the electronic performance of the UK-2/S-52 flight 1 spacecraft throughout the thermal-vacuum exposure is included in this report. The data collected, calibrations performed, and analyses made, to evaluate the performance of the spacecraft throughout the exposure are included in the appropriate sections of this report. Test procedures and instrumentation are also covered. Author

N66-29481*# National Aeronautics and Space Administration, Washington, D. C.
SURVEYOR I: A PRELIMINARY REPORT
Jun. 1966 50 p refs
(NASA-SP-126) CFSTI: HC $0.75/MF $0.50 CSCL 22B

This report briefly describes the Surveyor I mission objectives; the launch vehicle, spacecraft, and spacecraft components; the spacecraft trajectory; and its tracking and data acquisition. Emphasis is placed on the scientific data received from Surveyor on lunar surface features. These data show that the terrain surrounding the spacecraft landing site is a gently rolling surface studded with craters ranging from a few centimeters to several hundred meters in diameter and littered with fragmental debris ranging in size from less than 1 mm to more than 1 m. The surface is composed of granular material of a wide size range. Coarse blocks of rock and smaller fragments are set in a matrix of fine particles too small to be resolved. This material was disturbed by the spacecraft footpads which penetrated to a few centimeters, and is made up of lumps that are probably aggregates of much finer grains. These aggregates show that the fragmental material on the lunar surface is slightly cohesive. It this material is homogeneous to a depth of some tens of centimeters, the soil appears to have a static bearing capacity of about 5 psi. Thermal data indicate that the spacecraft temperature control surfaces are not covered by dust. R.N.A.

N66-29482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITING SOLAR OBSERVATORY SATELLITE OSO I: THE PROJECT SUMMARY
Washington, NASA, 1965 308 p refs
(NASA-SP-57) GPO: HC $2.00; CFSTI: MF $1.75 CSCL 22B

This document describes the work performed in connection with the Orbiting Solar Observatory satellite and the scientific data and results obtained. Included are discussions of the OSO program, spacecraft dynamics, structural design and fabrication, control systems, data acquisition and command system, power supply, thermal control, scientific experiments, and test program. R.N.A.

N66-29512*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-39, VOLUME VI FOR THE PERIOD MARCH 1, 1966 TO APRIL 30, 1966. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES
31 May 1966 27 p
(Contract NAS7-100)
(NASA-CR-75931; JPL-SPS-37-39, Vol. VI) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Project activities and supporting research and advanced development efforts conducted for various space exploration programs are documented. Technical activities for the Surveyor project, the Mariner 1967 project, the Mariner Mars 1969 project, and the Voyager project are summarized. Additionally the facilities and the operational activities of the Deep Space Network are examined. H.S.W.

N66-29626*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GEMINI MIDPROGRAM CONFERENCE INCLUDING EXPERIMENT RESULTS
Washington, NASA, 1966 417 p refs Conf. held at NASA Manned Spacecraft Center, Houston, Tex., 23–25 Feb. 1966 (NASA-SP-121) GPO: HC $2.75; CFSTI: MF $2.00 CSCL 22A

Conference papers on Gemini spacecraft and launch vehicle development and performance, flight operations, mission results, and physical science and biomedical experiments performed. For individual titles see N66-29627–N66-29670.

N66-29627*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GEMINI PROGRAM FEATURES AND RESULTS
Charles W. Mathews, Kenneth S. Kleinknecht, and Richard C. Henry *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 5–12 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Intrinsic features and general results of the Gemini program are discussed. Attention is given to systems design and the inclusion of redundancy for enhancing reliability, applicability of findings to future space programs, buildup of mission complexity, and mission operations. Launch preparation, flight planning flexibility, and postflight analysis and reporting are considered, as are flight crew exposure and personnel motivation. M.W.R.

N66-29628*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT DEVELOPMENT
Duncan R. Collins, Homer W. Dotts, Wilburne F. Hoyler, and Kenneth F. Hecht *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 15–23 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Flight sequence, spacecraft design, pyrotechnic applications, escape modes, and safety features are discussed in terms of the development of the Gemini spacecraft. Launch, in-orbit configuration and capability, and reentry and landing sequences are considered; as are the structure and four major subassemblies of the reentry vehicle. Effects of reentry heating for the Gemini II spacecraft are illustrated, and spacecraft reentry heating is graphed as a function of time. Details are included for the retrorocket-adapter section, and typical pyrotechnic devices are shown. The incorporation of redundancy features into all Gemini systems and selected components is related to the safety features, which are also discussed. M.W.R.

N66-29629*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GUIDANCE, CONTROL, AND PROPULSION SYSTEMS
Richard R. Carley, Norman Schulze, Benjamin R. Drone, David W. Camp, and John F. Hanaway *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 25–37 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Development and operation of the Gemini spacecraft's guidance, control, and propulsions systems are discussed. An on-board digital computer, an inertial reference platform, and a radar system comprise the guidance system, and location of these components in the spacecraft is shown; as are the components of the control system: (1) redundant horizon-sensor systems, (2) attitude controller, (3) two translation-maneuver hand controllers, and (4) attitude control and maneuvering electronics. The orbital attitude and maneuver system uses a hypergolic bipropellant of monomethylhydrazine and nitrogen tetroxide which is supplied to the engines by a regulated pressurization system using helium gas stored at 2800 psi. Flight performance of the Gemini spacecrafts is discussed, including rendezvous velocity comparisons, operating hours of the various components of six Gemini spacecraft, reentry navigation, and typical retrofire maneuver velocity. M.W.R.

N66-29632*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CREW STATION AND EXTRAVEHICULAR EQUIPMENT
R. M. Machell, J. C. Shows, J. V. Correale, L. D. Allen, and W. J. Huffstetler *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 57–70 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Housing arrangement within the cabin, lighting provisions in the crew compartment, and stowage arrangement are discussed for the Gemini crew station. The spacecraft instrument panel is shown, and details are presented for the displays and controls. Experiences in flight indicate that the Gemini crews were able to determine spacecraft attitude and rates and to control the vehicles more accurately than initially anticipated. Therefore, markings on the altitude indicator and flight director needles were increased to provide greater precision in reading pitch and roll attitudes and rates. Beginning with Gemini VI, a mission-elapsed-time clock was added to the instrument panel to avoid any confusion between Greenwich mean time and mission elapsed time when timing onboard functions. Space suits and equipment necessary for the flight crew are discussed; as are food, water, waste, and personal hygiene provisions. An extravehicular operation on Gemini IV is reported which showed the need for greater cooling capacity and greater propellant duration for subsequent extravehicular missions. M.W.R.

N66-29633*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ENVIRONMENTAL CONTROL SYSTEM
Robert L. Frost, James W. Thompson, and Larry E. Bell *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 71–77 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Space suit, water management, and coolant subsystems are considered for the Gemini spacecraft, and performance of the environmental control system is discussed for the first seven Gemini missions. The suits-off position during Gemini VII, reported to be the most comfortable, had very little effect on cabin environment. It appears that the metabolic heat load of the crew during periods of high activity may exceed 500 Btu per hour per man. Condensation was not a problem during flight, and only during Gemini VII did the crew report periods in which there was enough free moisture leaving the inlet hoses to cause significant condensation. Cabin temperature did not increase during reentry, and only during Gemini II was there a pressure drop exhibited in the cryogenic containers. It is concluded that the value of the extensive ground test program was confirmed by good flight results with a minimum number of anomalies. M.W.R.

N66-29634*# McDonnell Aircraft Corp., St. Louis, Mo.
SPACECRAFT MANUFACTURING AND INPLANT CHECKOUT
Walter F. Burke *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 79–88 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The importance of teamwork is stressed in the development of the Gemini spacecraft, and the corporate organization to assure maximum utilization of resources is discussed in connection with manufacturing and inplant checkout procedures. Both the Gemini modular concept of operations and the manufacturing working plan are reviewed, and management communications and procedures control are discussed and illustrated. Attention is given to spacecraft assembly, installation, white room checkout, the space simulation chamber, and spacecraft delivery. M.W.R.

N66-29635*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT RELIABILITY AND QUALIFICATION
William H. Douglas, Gregory D. Mc Intosh, and Lemuel S. Menear *In its* Gemini Midprogram Conf. including Expt. Results 1966 p 89–99 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Conventional concepts were employed in the reliability and qualification program for the Gemini spacecraft, with emphasis on establishing high inherent reliability and low crew hazards characteristics. A closed-loop failure-reporting and corrective-action program was adopted which required analysis, cause determination, and correction for all failures, malfunctions, or anomalies. Examples of redundancy employed to meet the overall reliability goal for the spacecraft include: (1) installation of two completely independent reentry control propulsion systems, (2) duplicate horizon sensors in the guidance system, and (3) the use of six fuel-cell stacks in the electrical system which can operate on three. Crew safety was emphasized in all planning, and redundant coolant subsystems were incorporated into the environmental control system. Design models of the Gemini were used to conduct numerous integrated system tests, system qualification tests, and overall reliability testing. The results of digital command system reliability tests are tabulated, various random vibration tests are graphed, and a typical test sheet is shown for digital computer components. M.W.R.

N66-29636*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LAUNCH VEHICLE MANAGEMENT
Willis B. Mitchell and Jerome B. Hammack *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 103–108 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Management activity in the Gemini launch vehicle program centered on the selection of the Titan II launch vehicle and its adaptation to Gemini mission requirements. Necessary modifications to enhance the basic reliability of the Titan II through the use of redundant systems included changes in flight control and electrical systems. A malfunction detection

system was incorporated to give the crew the necessary capability to diagnose impending problems and to determine proper action. A configuration management system, consisting of the Air Force Configuration Change Board and members of the NASA Gemini Program Office, was formed to coordinate modification activities. G.G.

N66-29637*# Martin Co., Baltimore, Md.
GEMINI LAUNCH VEHICLE DEVELOPMENT
Walter D. Smith *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 107–124 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

This paper presents a brief description of the basic modifications made to the Titan II to adapt it to a Gemini launch vehicle, the ground rules under which they were made, how the principal systems were initially baselined, how they evolved, and how they have performed to date. Author

N66-29639*# Aerospace Corp., El Segundo, Calif.
GEMINI LAUNCH VEHICLE GUIDANCE AND PERFORMANCE
Leon R. Bush *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 133–139 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

This paper reviews flight-test results in terms of success in meeting the overall system performance objectives of the Gemini launch vehicle program. Areas discussed include guidance system development, targeting flexibility, guidance accuracy, trajectory prediction techniques, and achieved payload capability. Author

N66-29640*# Air Force Systems Command, Los Angeles, Calif. Space Systems Div.
PRODUCT ASSURANCE
Robert J. Goebel *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 141/145 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

The more significant principles and ground rules which were established for product assurance in the Gemini launch vehicle program are listed, and their purpose, application, and results are discussed. These include maximum use of all failure data, maximum component maturity, limitation of repair and test, rejection of unexplained transient malfunctions, strict configuration management, and detailed customer review.

N66-29641*# Air Force Systems Command, Los Angeles, Calif. Space Systems Div.
DEVELOPMENT OF THE GEMINI LAUNCH VEHICLE
Richard C. Dineen *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 147–149 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A discussion is given of the reliability measures and management philosophies adopted in modifying the Titan II for use as the Gemini launch vehicle. Also discussed are the results obtained in the Gemini program, with emphasis on the perfect safety record. It is reported that areas receiving special attention in developing the new drawings, engineering specifications, and procedures included the following: (1) modification of the vehicle subsystems, (2) a pilot safety program, (3) improved reliability of the vehicle, (4) reduction of the checkout time without degrading reliability, (5) evolution of guidance equations to meet Gemini requirements, (6) data comparison techniques and the configuration-tab printout comparison used to insure that the launch of Gemini VI-A was accomplished with no degradation in reliability or no additional risk assumption, and (7) Gemini training, certification, and motivation programs. C.T.C.

N66-29642*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GEMINI MISSION SUPPORT DEVELOPMENT
Christopher C. Kraft, Jr. and Sigurd Sjoberg *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 153–155 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Gemini mission support operations were developed from the basic concepts of Project Mercury. Significant changes in the ground-support system have been the use of automatic, high-speed processing of telemetry data, and multiple-shift flight-operations support for the longer mission durations and rendezvous techniques. It was concluded that the flight operations objectives of the Gemini Program are being successfully fulfilled and can be extended in support of Apollo lunar landing missions. G.G.

N66-29646*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GEMINI POSTLANDING SYSTEMS TESTS AND RECOVERY OPERATIONS
Robert F. Thompson, Donald E. Stullken, and Peter J. Armitage *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 189–200 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

Systems operational evaluation, development, and validation prior to flight are presented, and the testing performed to support this philosophy is reviewed. The adequacy of this test program has been verified by the satisfactory performance to date, wherein all postlanding systems have performed as expected and wherein there have been no significant failures on actual flight missions. Overall recovery operational support plans are summarized, and techniques are discussed for locating the spacecraft after landing and providing on-scene assistance and retrieval. The various landing situations encountered to date in the Gemini Program are presented, and the recovery activities reviewed. Recovery operational support has been very satisfactory for all landing situations encountered. The operational flexibility provided by multiple landing areas has proved to be very valuable, in that it allowed the Gemini V mission to continue while a spacecraft electrical-power problem was being evaluated. Author

N66-29648# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACECRAFT LAUNCH PREPARATION
Walter J. Kapryan and Wiley E. Williams *In* NASA. Manned Spacecraft Center Gemini Midprogram Conf. Including Expt. Results 1966 p 213–219 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

This paper presents a general resume of Gemini spacecraft launch preparation activities. It defines basic test philosophy and checkout ground rules. It discusses launch site operations involving both industrial area and launch complex activities. Spacecraft test flow is described in detail. A brief description of scheduling operations and test procedures is also presented. Author

N66-29654*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RENDEZVOUS OF GEMINI VII AND GEMINI VI-A
Thomas P. Stafford, Walter M. Schirra, and Dean F. Grimm *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 283–297 (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A description of the rendezvous techniques, procedures, and flight data charts developed for the Gemini VI-A mission is presented in this paper. The flight data charts and crew time-line activities were developed over an 8-month period. Successful rendezvous is critcally dependent on the presentation to the flight crew of sufficient information developed onboard the spacecraft. The Gemini VI-A flight crew used this information to evaluate the rendezvous progress by several different methods and made critical decisions based on their evaluation. The system combination found most effective in making these evaluations was the range-rate data from the radar, and the angle data from the platform. Author

N66-29655*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXPERIMENTS PROGRAM SUMMARY
R. O. Piland and P. R. Penrod *In its* Gemini Midprogram Conf. Including Expt. Results 1966 p 305–312 refs (See N66-29626 16-31) GPO: HC $2.75; CFSTI: MF $2.00

A complement of experiments of medical, scientific, and technological significance, conducted during the Gemini flight program are discussed. The total program is summarized in a table which shows for each experiment, the numerical identification, name, principal investigator, organizational affiliation, and flights to data. The objectives of each mission are outlined and a brief discussion of procedures followed and results to date for each experiment are presented. L.S.

N66-29740*# IIT Research Inst., Chicago, Ill.
SPACECRAFT COST ESTIMATION
W. P. Finnegan and C. A. Stone May 1966 39 p refs (Contract NASr-85(06))
(NASA-CR-76015; C-6) CFSTI: HC $2.00/MF $0.50 CSCL 22B

The relative cost significance of each of the spacecraft subsystems, and the accuracy with which a linear model based on spacecraft weights could be expected to predict future spacecraft costs were studied. A linear cost estimation equation was evolved which includes three subsystem weights as parameters. This equation yields a significant reduction in root mean square percentage error, and was used in evaluating predictability. The significance of individual subsystem cost estimation, the significance of relative costs of spacecraft subsystems, and the multivariable cost estimation model are discussed. It was concluded that the relative cost significance of spacecraft subsystems in a linear regression model is established. Telecommunications and data handling was found to be the most important single factor, with structure and propulsion also being significant. It was further concluded that this model can easily provide cost estimates for long range planning purposes. N.E.N.

N66-29894# RAND Corp., Santa Monica, Calif.
STATISTICAL ANALYSIS OF SPACECRAFT REPLENISHMENT
G. E. Modesitt Mar. 1966 34 p refs
(Contract ARPA SD-79; ARPA Order 189–61)
(RM-4739-ARPA; AD-631942) CFSTI: HC $2.00/MF $0.50

This memorandum discusses the number of launches required to establish and maintain a spacecraft system. The mean and dispersion in number of launches are derived for a system consisting of an arbitrary number of exponentially decaying spacecraft and with a constant probability for successful replenishment launches. The report shows the dependence of these results on the spacecraft mean lifetime, the launch success probability, and the number of spacecraft per launch. The results are useful in estimating the probable costs of various spacecraft systems and should be of assistance in comparing such systems. The memorandum was prepared as part of the Advanced Research Projects Agency's VELA analysis study. An abridged version of this memorandum was published in the Proceedings of the IEEE: Special Issue on Nuclear Test Detection, December 1965. Author (TAB)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-28426*# Lehigh Univ., Bethlehem, Pa.
STRESS INTENSITY FACTORS FOR AN INFINITE PLATE WITH RADIAL CRACKS EMANATING FROM AN INTERNAL HOLE AND SUBJECTED TO CYLINDRICAL BENDING Progress Report
Richard Roberts and Thomas Rich Apr. 1966 35 p refs (Contract NGR-39-007-011; GRANT NSF GK-344)
(NASA-CR-75699) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The stress intensity factors for an infinite plate with radial cracks emanating from an internal hole and subjected to cylindrical bending are determined. The method used presents a general technique for determining the stress intensity factors for cracks emanating from voids of arbitrary shape in sheet materials. The possibility of an analogy between shear and bending problems is presented, where the more difficult problem of bending may be handled by using the solutions obtained for shear problems. Author

N66-28456# Naval Research Lab., Washington, D. C. Shock and Vibration Information Center.
THE SHOCK AND VIBRATION BULLETIN, NO. 35, PART 4
Feb. 1966 243 p refs Proc. of Symp. on Shock, Vibration and Assoc. Environments, New Orleans, 25–28 Oct. 1965 (AD-631233) CFSTI: HC $6.00/MF $1.25

Symposium papers on instrumentation are presented. For individual titles see N66-28457—N66-28478.

N66-28457# Naval Research Lab., Washington, D. C.
INTEGRATION AND DOUBLE INTEGRATION—A PRACTICAL TECHNIQUE
Merval W. Oleson *In its* The Shock and Vibration Bull. Feb. 1966 p 1–10 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

In a series of shock evaluation tests, both the value and the feasibility of structural analysis in the time domain have been demonstrated. The approach was to measure dynamic

motion with an accelerometer, and by successive integrations to produce simultaneous records of all three motion parameters, acceleration, velocity, and displacement. The results were quite striking. Simultaneous motion representations in a multi parameter format produced important interpretations of structural behavior–interpretations which were uniquely related to the format. It is concluded that the technique could be profitably adapted to other measurement situations also. Author

N66-28458# Aerospace Corp., Los Angeles, Calif.
THE MEASUREMENT OF INTERNAL DYNAMICS OF EQUIPMENT
Charles T. Morrow *In* NRL The Shock and Vibration Bull. Feb. 1966 p 11–16 ref (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

The instrumentation characteristics, limitations, and techniques for measurement of equipment dynamics are discussed. The optical stroboscope is mentioned as giving a quick visual picture of dynamic behavior, but also as being inherently amplitude responsive qualitative except for frequency measurements. Conditions appropriate for resonance characteristic measurements when the equipment shows significant sensitivity to mounting conditions are mentioned. Capacitative, electromagnetic, and wire-coupled vibration probes are described. A combination of vibration probe and a fixed force gauge or accelerometer, used with a Lissajous figure technique, was shown to be particularly promising for equipment resonance measurements. N.E.N.

N66-28467# Measurement Analysis Corp., Los Angeles, Calif.
FIRST OCCURRENCE PROBABILITIES FOR EXTREME RANDOM VIBRATION AMPLITUDES
Cory L. Gray *In* NRL The Shock and Vibration Bull. Feb. 1966 p 99–104 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

The problem of a failure caused by the first occurrence of a statistically rare, extreme vibration amplitude is investigated theoretically and partially verified by experiment. Such failures might be associated with the exceedance of an ultimate strength, a preload, or an allowable deflection. Although an exact solution to the problem is unknown, equations which form theoretical bounds are presented. These equations answer the questions: How many times can a particular random vibration be sampled for specific time periods before a critical amplitude will be observed? Or, given an observation period, what is the maximum amplitude that will be reached during that time with specified probability? The theoretical results are shown to compare favorably with analog computer data for the special case of simple, mechanical oscillator response. Finally, it is shown how the analysis can be applied to practical engineering problems. Author

N66-28469# Honeywell, Inc., St. Petersburg, Fla.
A MEANS TO REDUCE RANDOM VIBRATION ANALYSIS TIME
N. Behringer and R. W. Lochner, Jr. *In* NRL The Shock and Vibration Bull. Feb. 1966 p 121–128 refs (See N66-28456 16-32) CFSTI: HC $6.00/MF $1.25

This paper presents results of an investigation to evaluate several techniques by means of which appreciable time savings could be realized during the analysis of random vibration test data. These savings can be accomplished without sacrifice of statistical accuracy. The time required to perform a typical analog, a sweep-type, spectrum analysis and the attendant accuracy were used as baselines for comparison. Initial reductions of analysis time were achieved by performing step analyses by use of an analog analyzer. A time saving of 4 to 1 was realized. Additional significant reductions of analysis time were achieved by manipulating tape recorder speeds. Random vibration data were recorded on magnetic tape at slow speed and played back at a faster speed. An analysis filter was selected that enabled the reduction of analysis time by a factor of 8 to 1. A combination of the two techniques, step analysis and tape speed changing, provided reductions of analysis time on the order of 32 to 1. Author

N66-28481*# General Electric Co., Philadelphia, Pa.
STRUCTURAL MECHANICS OF DEFORMATION AND FRACTURE Final Report
I. J. Gruntfest and G. E. Mueller May 1966 109 p refs (Contract NASw-1190)
(NASA-CR-75706) CFSTI: HC $4.00/MF $0.75 CSCL 20K

Analytical methods for studying the mechanical behavior of materials having temperature dependent properties were developed; and realistic model experiments were studied. In particular, the dynamics of simple deformations of homogeneous and heterogeneous model materials were considered. Stick-slip effects characteristic of real ductile materials were demonstrated. Plastic flow was simulated, and a model designed to relate the gross features of the deformation to crystal defects in the material were studied. The analytical schemes used involve the use of improved versatile electric analogs of the mechanical models. The temperature dependent viscosity in the model materials is simulated by thermistor elements for which the temperature dependence of the resistance is described in terms of an energy of activation. The inductors and capacitors that ordinarily simulate the inertial and elastic effects in the material are further simulated by precision electronic integrators, thus eliminating the problem of obtaining matched components with a wide range of values. The simulated inductors are linear and have no resistance; qualities that real inductors do not have. In addition, the effective values of the components can be made readily responsive to the local values of the stress, strain, or strain rate. L.S.

N66-28557# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CREEP OF MEMBRANE SHELLS OF REVOLUTION UNDER LARGE DEFORMATIONS
L. M. Kachanov [1965] 10 p refs Transl. into ENGLISH from Issled. po Uprug. i Plastichn. (Leningrad), no. 4, 1965 p 65–71

Large deformations of the creep of a thin walled shell of revolution showing the effects of internal pressure and axial stress are discussed, and integral equations are formulated for the solution of the problem. The system proposed is then numerically integrated by steps. An approximate solution to the problem, starting from the variational equation of shell creep, is examined. It is noted that if the shell bulges noticeably, it is expedient to assume that the flow is developed along the normal to the surface. From the mathematical functions presented, an analogous analysis in the problem of creep of a thin walled shell subject to uniform pressure is facilitated. It was also pointed out in the problem considered that considerable deformations are sometimes admissible in creep, and that the analysis of large deformations is needed to determine the time of viscous failure. R.U.

N66-28598# Texas Univ., Austin. Defense Research Lab.
PRESSURE DISTRIBUTIONS ON SINGLE AND TANDEM CYLINDERS MOUNTED ON A FLAT PLATE IN MACH NUMBER 5.0 FLOW
William H. Miller 1 Jun. 1966 87 p refs Prepared for APL (DRL-538; CR-25)

The distributions of pressures on short, circular cylinders mounted perpendicular to a flat surface and protruding into supersonic air flow were determined. Schlieren photographs of the associated flow fields supplemented these data. Tests were conducted under adiabatic conditions with a free-stream Mach Number of 4.88 and a Reynolds Number of 5.76×10^5. Protuberance heights ranging from 0.23 to 6 times the local thickness, δ, of the turbulent boundary layer on the supporting surface were investigated. Upstream, shear-layer separation occurred for model heights $L > \delta/2$. A region of two-dimensional flow was found for models of heights of 6 δ and greater, with characteristic values of $C_{P_{Stagnation}} = 1.85$, $C_{D_{Sectional}} = 1.29$, $\theta_{Separation} \approx 120°$ and a ratio of bow-shock detachment distance to model diameter of 0.234. Pressure distributions for the aft model of a tandem arrangement of cylinders were likewise determined. The model pressure loading in certain tandem configurations was found to exceed the corresponding local single-cylinder values. Form-drag coefficients, determined by graphical integration of the pressure data, correlated well with total drag coefficients reported in the literature. Author

N66-28599# Martin Co., Baltimore, Md.
VIBRATION OF MEMBRANE FOILS
Norris J. Huffington, Jr. Mar. 1966 52 p refs
(RR-74)

The vibration characteristics of thin foil panels, which have numerous applications in the satellite and space probe fields, have been analyzed by use of the Ritz method. Such vibrating systems are essentially nonlinear, although the nonlinear behavior can be reduced by maximizing the pre-stretch. Besides the first order nonlinear effects, the analysis includes the reactance of the surrounding medium, which is shown to have a significant effect on the lower modes. The analytical procedure is illustrated by a comprehensive example, in which a rectangular panel is supported at the corners by helical springs. Results of this analysis compare favorably with available experimental data. Author

N66-28652# General Dynamics/Convair, San Diego, Calif.
SIMPLEX DECOMPOSITIONS FOR UNIFORM BEAMS
J. W. Wissmann Jan. 1966 53 p refs
(GDA-ERR-AN-715)

A uniform beam of arbitrary length is replaced by an array of simplex structural elements (bars and triangular plates) for the purpose of analysis in a three dimensional structural dynamics program. A complete beam and displacement match is achieved under shear, bending, and longitudinal loads so that the two elastic models become indistinguishable in the analysis. The shear stresses and the average longitudinal stresses in the extreme fibers are also matched for the eventual use in a stress analysis. For the use in short beam elements, simplified equations are derived and the resulting stiffness error is determined. Author

N66-28686# Naval Research Lab., Washington, D. C. Shock and Vibration Information Center.
THE SHOCK AND VIBRATION BULLETIN, NUMBER 35, PART 5
Feb. 1966 329 p refs Presented at the 35th Symp. on Shock, Vibration and Associated Environments, New Orleans, 25-28 Oct. 1965
(AD-631234) CFSTI: HC $7.00/MF $1.75

Symposium papers on transportation studies and on shock and vibration isolation are presented. For individual titles see N66-28687-N66-28711.

N66-28687# General American Transportation Corp., Niles, Ill. MRD Div.
A SURVEY OF SHOCK AND VIBRATION ENVIRONMENTS IN THE FOUR MAJOR MODES OF TRANSPORTATION
R. W. Schock (NASA, Marshall Space Flight Center), and W. E. Paulson (Brown Eng. Co.) *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 1-19 (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75
(Contract NAS8-11451)

An investigation has been conducted, the purpose of which was a review of all available information and test data describing shock and vibration environments in the four major modes of transportation. This information has been collated, analyzed, and combined, to provide a unified reference source of transportation environments for use by the packaging and/or design engineer. A portion of the results of this investigation are presented in this paper. Author

N66-28688# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DYNAMIC ENVIRONMENT OF SPACECRAFT SURFACE TRANSPORTATION
J. W. Schlue *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 1 21-36 (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75
(Contract NAS7-100)

The data presented in this report include shock and vibration measurements over rough irregular roads, plus vibration measurements over smooth highways. Comparisons are made between different vans, smooth and rough roads, and three different locations within the same van. Data plots envelop the maximum, 95 and 50 percentile levels of shock spectra and power spectral densities. A discussion of instrumentation applicable to measurements of transportation dynamic environments is contained in the appendix. Electrical and mechanical instrumentation are included. Author

N66-28689# Aberdeen Proving Ground, Md.
A REALISTIC DERIVATION OF A LABORATORY VIBRATION TEST TO SIMULATE THE OVERLAND TRANSPORTATION ENVIRONMENT
John A. Kasuba *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 37-48 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

This paper treats the problem of deriving a vibration schedule for securely tied down vehicle cargo. The derivation is based on the principle of equivalent damage which relates the severity of the field and laboratory environments. This principle was applied in deriving an automotive test schedule to simulate the overland cross-country and paved road transportation environments of truck, tracklayer, and trailer-type vehicles. The automotive test schedule was combined with the existing aircraft test schedule to present a more complete transportation environment. Author

N66-28690# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A METHOD FOR ESTIMATING ACCELERATIONS OF SHIPPING CONTAINERS MOUNTED ON AN IMPACTING RAILROAD CAR

John J. Scialdone *In* NRL Shock and Vibrstion Bull., No. 35, Pt. 5 Feb. 1966 p 49–56 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

A method is presented for estimating the response of a container and its contents, when a railroad car on which they are mounted impacts a group of braked cars standing in a classification railroad yard. Equations are derived for the container car impact equivalent velocity, container car acceleration, car body transmissibility, and container transmissibility. By applying characteristic data of the car and its coupler, the natural frequency of the car is calculated, and the equivalent impact velocity to the container car is obtained from the actual impact speed and the car weights. Then, input accelerations of the car and shipping container are calculated over a 1-to-14-mph range of input velocities, for bottoming and nonbottoming of the coupler during impact. From these results, the container transmissibility is obtained, since we know the inner container design natural frequency, its damping characteristics, and the forcing frequencies resulting from the impact at the car coupler. Author

N66-28691# Sandia Corp., Albuquerque, N. Mex.

PRELIMINARY ANALYSIS OF DATA OBTAINED IN THE JOINT ARMY/AEC/SANDIA TEST OF TRUCK TRANSPORT ENVIRONMENT

J. T. Foley *In* NRL Shock and Vibration Bull., No. 35, Pt. 5, Feb. 1966 p 57–70 refs Sponsored by AEC (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

This paper describes the manner in which the data obtained during the joint Army/AEC/Sandia test of truck transport environment was evaluated to arrive at the "best means" for reduction, presentation, and analysis. Four systems of data reduction and presentation were used on experimental portions of the truck test data, and the resultant out-puts of each reduction system were evaluated to arrive at the best means of describing the environment. Author

N66-28692# Goodyear Aerospace Corp., Litchfield Park, Ariz.

ROUGHNESS MEASUREMENT AND SYSTEM RESPONSE EVALUATION FOR HIGHWAY ENVIRONMENT

J. R. Harvey and R. A. Wursche *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 71–85 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

The paper presents analytical procedures to evaluate the shock and vibration environment of highway mobile transport vehicles. The road roughness measurement technique was used to obtain the road profiles and power spectral density estimates of a large number of road samples in West Germany and Central Arizona. The generated roughness data were used as input to a representative highway mobile weapons system to obtain the statistically average and peak system response. The calculated response data are then summarized to predict the dynamic environment of the payload and the transport vehicle. Author

N66-28693# United Technology Center, Sunnyvale, Calif.

PROGRAM 624A—TITAN III-C TRANSPORTATION TESTS

Louis A. Molinari and Jack R. Reynolds (Space Systems Div.) *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 87–113 ref Sponsored by AF (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Test results indicate that the special rail and highway transporters, containers, AGE and environment systems fulfilled the requirements of the Program 624A (Titan III-C) Program. Either rail or highway transport system will provide protection of the SRM components against all normal transportation environments and assure that the maximum allowable 3-g shock, 50 percent humidity, and 60° to 90°F temperature range will not be exceeded. Results also illustrate that the common carrier industry range of equipment includes equipment of standard make which can be modified to accept shipments satisfactorily of excess weight, dimension, and sensitive nature. Thus, these test results can lead to the fulfillment of the need of both the purchaser and supplier of missile and space-age equipment to substitute transport systems composed of combinations of modified standard components, common to industry and readily available in the market, for systems requiring individual design and special fabrication at the cost of considerable time and money. Author

N66-28694# Hughes Aircraft Co., Culver City, Calif.

DYNAMIC ENVIRONMENT OF M-113 ARMORED PERSONNEL CARRIER

G. M. Pomonik and N. G. Tinling *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 115–128 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

A measurement program was conducted to determine the shock and vibration environment of the TOW weapon system installation in the M-113 armored personnel carrier. Data were obtained over a range of vehicle speeds and road conditions and at various vehicle locations to provide general information on the M-113 dynamic environment. Vibration data are presented for vehicle speeds between 5 and 35 mph on both dirt and asphalt roads. Data for significant conditions is presented as acceleration spectral density and amplitude distributions. The broadband results are summarized as functions of vehicle speed and measurement location. Shock data were obtained for vehicle speeds from 7 to 13 mph over wooden ramps on a dirt and asphalt Munson course. Shock spectra of the most severe data are presented. The results are summarized as functions of vehicle speed and measurement location. Author

N66-28695# Goodyear Aerospace Corp., Akron, Ohio.

INTERPRETATION AND APPLICATION OF SPECIFICATION REQUIREMENTS THAT SIMULATE VIBRATION RESPONSE OF EQUIPMENT BEING SHIPPED BY COMMON CARRIER

James E. Rice *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 129–132 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

The object of this pape is to encourage investigations which will show that vibrati n resonance dwell test requirements that simulate loads rel ed to transportation by common carrier are not realistic for ce tain conditions. It is felt that the test frequency ranges and inputs are too high for items weighing 1000 lb or more. Of the various criteria currently used to establish transport tion load criteria, MIL-STD-810 was chosen for discussion, since it clearly displays the problem. By examination of the dynamic characteristics of the

common carriers, it can be shown that steady state vibration loads at values large enough to cause damage are not present at frequencies greater than 30 cps for items weighing 1000 lb. It is felt that the criteria as now presented can encourage poor designs and introduce unnecessary costs of producing military hardware for the weight range considered. Author

N66-28696# Lockheed Missiles and Space Co., Sunnyvale, Calif.
NEAR-OPTIMUM SHOCK MOUNTS FOR PROTECTING EQUIPMENT FROM ACCELERATION PULSES
Ralph E. Blake *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 133–146 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

In this theoretical study, the properties of a mount are defined by the dynamic force-deflection curve. To relate mount properties to strength required in equipment, an "index of severity" is developed from the normal-mode theory of structural response. The best mount is the one which minimizes the index of severity of the shock transmitted to the equipment. The mount force-deflection curve was fixed except for three shape parameters. The problem of finding the optimum set of parameters was then programmed for a computer. The resulting solution is "near-optimum" in that the shape was constrained except for three parameters and typical properties of the equipment were assumed. However, comparison with a theoretical lower bound on the index of severity suggests that there is not room left for great improvement. Shape parameters, indices of severity, and shock severity spectra are reported for several cases. Shock severity spectra are similar to shock spectra but are modified to give more emphasis to vibratory response in equipment. Author

N66-28697# Pennsylvania State Univ., University Park.
SHOCK ATTENUATION USING PASSIVE ELEMENTS
V. H. Neubert, D. L. Pyke, and D. F. Poeth (HRB-Singer, Inc.) *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 147–157 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75
(Contract Nonr-656(28)(X))

In ships or other vehicles, it may be desirable to add mass or passive dynamic absorbers to protect mounted equipment from shock inputs. Also, the equipment itself will act as a dynamic absorber with respect to motion of its base, as is known from the shock spectral dip phenomena. Studies were carried out to investigate the magnitude of the effect of using masses, compared with masses on springs, as passive absorbers. Also, a nonlinear absorber was studied where the mass was supported by a bolt with relatively low preloads so that separation of the mass from the base could easily occur in one direction only. Response of a thin free–free bar of circular cross-section is compared with that of the same bar with masses or mass and spring combinations attached at the end opposite the struck end. For the second system, a disc was attached to a short, thick steel cylinder using a single preloaded bolt, simulating in ships the use of hold-down bolts to attach equipment bedplates to foundations. By measuring bolt strain and base acceleration a fairly clear physical picture of the motion occurring was obtained. Author

N66-28698# Naval Applied Science Lab., Brooklyn, N. Y.
INVESTIGATION OF THE VIBRATION DAMPING PROPERTIES OF VISCOELASTIC MATERIALS USING A DELAY ANGLE TECHNIQUE
Saul A. Eller and Levi Cohen *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 159–168 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

The vibration damping properties of 1/4-, 1/2-, and 2-in. thicknesses of ML-D2 and a urethane viscoelastic damping material were studied in the frequency range of 150 to 11,000 cps by disc and beam methods, which measured the rate of vibration decay in the steel substrates onto which the materials were adhered. Results were expressed in terms of percent of critical damping of the material. In addition, the materials were investigated by a novel delay angle technique which measured acceleration ratio, velocity of sound, and delay angle over a frequency range of 50 to 10,000 cps. The ML-D2 material had better vibration damping properties than the urethane material at frequencies above 1,300 cps, whereas the reverse was true at lower frequencies. Analysis of the data obtained by the delay angle technique indicated that a frequency is reached at which only those portions of the material which are in contact with, or adjacent to, the substrate are vibrating, and thus absorbing energy. This is one explanation why vibration damping at all frequencies is not proportional to the thickness of the material. Author

N66-28699# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
ENERGY ABSORPTION BY DYNAMIC CRUSHING
C. V. David *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 169–178 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75
(Contract DA-49-146-XZ-366)

The dissipation of energy by crushing a structure is well known. If the crushing process is slow, the energy absorbed corresponds to the static crushing force times the amount of crushing. If the load is applied instantaneously and exceeds appreciably the static crushing reaction, a smashing process occurs and the specific energy absorption of the system increases. In this case, the reaction of the structure is considerably altered. The investigation of the dynamic behavior of such a crushable structure is described. Honeycomblike cores, 6 in. long, 12 in. in diameter, and of 0.008-in. thick stainless steel corrugated sheets, were assembled between two steel plates 1 in. and 1/4 in. thick. The 1/4-in. thick plate was accelerated to 600 to 700 fps and smashed and crushed the core against the 1-in. plate. Accelerometers mounted on the back of the 1-in. plate measured the reaction from the core against this plate. Similar samples were crushed statically, and the dynamic and static specific energies were compared. For the plate velocities investigated, an improvement by a factor of 2 to 3 of dynamic loading over static loading was obtained. Author

N66-28700# Lord Mfg. Co., Erie, Pa.
DRY FRICTION DAMPING WITH FORCE PROPORTIONAL TO DISPLACEMENT
Leon Wallerstein, Jr. *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 179–185 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Conventional friction dampers have certain shortcomings; among them are a potential for infinite resonance amplitude, a limitation on force isolation, the creation of static off-center conditions, and the introduction of harmonics not necessarily in the environment. If the friction force is made proportional to displacement, these deficiencies disappear or become unimportant, the exceptional vibration isolation can be realized. One form of such a damper is shown which exhibits both an elastic stiffness and a friction gradient for which

expressions are given. The friction gradient is two-valued and depends on the relative signs of displacement and velocity; its dual nature shows clearly in force-displacement tests. Self-centering is assured when the elastic gradient exceeds the minimum friction gradient. Analog computer solutions for a single degree of freedom system are given as transmissibility-frequency curves for several damping ratios. Resonance transmissibility depends only on the ratio of friction gradient to elastic gradient; it is (analytically) independent of input amplitude, as confirmed by model tests. Author

N66-28701# David Taylor Model Basin, Portsmouth, Va. Underwater Explosions Research Div.

RESPONSE OF RESILIENT MOUNTS UNDER SHOCK LOADING

E. A. Thornton and R. D. Short *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 187–191 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Experimental and theoretical studies of the type 5M10,000-H rubber resilient mount assembly consisting of a compression and shear mount and snubber were conducted to determine its performance under shock loading. In the experimental study, the mount assembly (supporting a rigid test mass) was installed on the Floating Shock Platform and subjected to a series of five shock tests. In the theoretical study, a simple mathematical model combining springs and dashpots was used to represent the response of the mounts under vertical shock loading. Dynamic force-deflection curves, obtained from the experimental and theoretical data, showed good agreement. The studies demonstrated that the viscous effects of rubber play a significant role under shock loading. Thus, the conclusion was that the behavior of resilient mounts for shipboard installations cannot be based on static tests alone. Author

N66-28702# Special Projects Consultants, Inc., Washington, D. C.

A NEW APPROACH TO PACKAGE CUSHIONING DESIGN

Gordon S. Mustin *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 193–202 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Dynamic shock absorption data for 16 different nonlinear cushioning materials were analyzed. It was found that the shock isolation information needed by the designer could be reduced to two curves for each material, plus a general envelop curve applicable to all of the materials. This finding, which is consistent with theory, represents an improvement over current use of an acceleration vs static stress curve for each thickness and for each drop height. As a result of this finding, the remaining challenges of nonlinear isolator technology can now be attacked. Among the most important of these are variations in isolator shape, temperature effects, viscoelastic behavior, and configurations with more than one degree of freedom. Author

N66-28703# IIT Research Inst., Chicago, Ill.

OPTIMAL SHOCK ISOLATION SYNTHESIS

T. Liber and E. Sevin *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 203–215 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

(Contracts AF 29(601)-6487; Nonr-4444(00)(X))

The problem of optimum shock isolator synthesis, in the sense of minimizing the relative isolator displacement for a prescribed level of input acceleration attenuation, has been formulated and solved for single degree of freedom systems. The methods of dynamic programming and linear programming are found applicable to a discrete version of the problem; the latter technique was more efficient. The optimal isolator is active, possessing the characteristics of "bang-bang" control. Results of optimal isolator performance are obtained for four types of input shock wave forms. These results, expressed as a relationship between limiting values of relative isolator displacement and mass acceleration, permit direct determination of the margin for improvement existing between the optimal and any specified candidate isolator design. The dependence of the optimal isolator performance on the detail of the isolator function and the input shock wave form is discussed. Author

N66-28704# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

VIBRATION ISOLATION THROUGH PNEUMATIC SPRING AND DAMPING

Russel L. Hall *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 217–226 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

This paper concerns the passive isolation of harmful shock and vibrations as applied to a relatively large package containing fragile data acquisition equipment. The shock isolator consisted of a lightweight cylinder containing compressed air and a piston which is fully extended at steady state. The air cylinder isolator functions as zero deflection support, spring and damper. Electronic simulation indicated that the air cylinder isolator will more effectively isolate single shock pulses than will other conventional systems. Author

N66-28705# General Dynamics Corp., Groton, Conn. Electric Boat Div.

DESIGN AND ADVANTAGES OF A TWO-STAGE MOUNTING SYSTEM FOR MAJOR MACHINES IN SHIP'S ENGINE ROOM

Robert M. Gorman *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 227–234 (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Approximately 100 tons of low-speed machinery had to be isolated in a surface ship's engine room. Standard single-stage mounting systems with sufficient attenuation characteristics would not have the rigidity to withstand the ship's rolling and slamming. It was decided, therefore, to use a two-stage mounting system incorporating a massive subbase on which all the machines would be isolation-mounted. The subbase would, in turn, be isolation-mounted to the ship's hull. An analytical comparison of one- and two-stage systems was made on the basis of attenuation and stability characteristics. A general transmissibility equation for the two-stage system was derived. Force transmissibility was analytically determined for a large range of mount damping, mount stiffness, and subbase weight. Results include a set of parametric curves. Hull impedance, obtained from experimental measurements on a similar hull, was included in the system's mathematical model. Author

N66-28706# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

MODELING OF SPACECRAFT FOR LOW-FREQUENCY NOISE REDUCTION

Richard H. Lyon, Robert E. Apfel, and Charles W. Dietrich *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 235–242 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

The acoustic isolation or "noise reduction" (NR) of spacecraft structures over most of the frequency range can be computed and/or measured by methods that can be termed "conventional." The increased interest in noise below 50 cps requires that extensions to these conventional methods be made, both in analysis and experiment. Conventional theory distinguishes between "mass law," or forced response, and reradiation and transmission of sound by resonant motion. The same considerations are appropriated to low-frequency NR. At low frequencies, the forced motion is stiffness controlled and derivable from "pressure vessel" analysis. The mechanical and acoustical resonances of the system modify this stiffness-controlled NR. Author

N66-28707# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.

FLEXIBLE TOROIDAL SPRING CHARACTERISTICS

C. V. David *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 243–259 refs Sponsored by AF (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Flexible toroidal springs have been investigated for an application including highly impulsive loading both on and off axis, and the results are reported. The present study was concerned with multitorus stacks and concentric multistack assemblies that operate as a unit. This arrangement therefore limits the torus mounting to clamping on the circle of tangency between the upper and lower tori and the plane of attachment. The torus spring can be submitted to four basic types of loading: compression–tension, bending, shear, and torsion. The characteristics of the spring are highly nonlinear, and exact solutions are almost impossible to calculate, especially for large deformations. Approximate analytical solutions were derived for three modes of loading: compression–tension, shear, and bending. Several small experimental torus spring systems have been constructed and tested both statically and dynamically. Also, the equations of motion, restoring forces, and moments corresponding to the dynamic testing of a plate attached to a three-torus spring system were simulated on an analog computer. Author

N66-28708# Honeywell, Inc., St. Petersburg, Fla. Aeronautical Div.

VIBRATION QUALIFICATION SPECIFICATION FOR INERTIAL MEASURING UNITS

S. L. Burgwin *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 261–270 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

The problem of rectified torques is discussed in this paper, and an approach to arriving at a more realistic specification is suggested. The discussion deals only with IMU's, but the same problems exist for any measuring instrument utilizing a moving element exposed to ambient vibration. Author

N66-28709# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Ssytems Div.

EVALUATION OF A DESIGN FACTOR APPROACH TO SPACE VEHICLE DESIGN FOR RANDOM VIBRATION ENVIRONMENTS

D. E. Hines and D. A. Stewart *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 271–306 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75
(Contract NAS8-11617)

Structural fatigue induced by random vibration often sizes bracket structures in modern aerospace vehicles. This document reports the results of an experimental study conducted to evaluate a design factor approach for application to the fatigue problem and to evaluate the design factor for cantilever beams. Author

N66-28710# Lockheed Missiles and Space Co., Sunnyvale, Calif.

AN APPLICATION OF DECISION THEORY TO A VIBRATION-FATIGUE PROBLEM

D. M. Aspinwall and R. E. Blake *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 307–319 refs (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

Statistical decision theory provides a model for the orderly consideration and weighing of a number of diverse factors and pieces of evidence which must be brought together in making a decision. As a realistic example of such a procedure, we discuss the problem of whether a certain Polaris missile structure will have acceptable fatigue strength throughout several years of exposure to submarine vibration. Available choices are: (a) to increase the design strength, with a penalty in weight and cost; (b) to accept the design as is and risk the development of service failures in the future; or (c) to spend more money on improving the data. The choice will depend on the relative values (utilities) which the project leader and/or customer place on these alternatives and on the risk of failures. The format required for this decision theory analysis is a probability density of reliability. A procedure for combining engineering judgments with experimental data on these important factors was used to develop the probability density for reliability. Author

N66-28711# Detroit Univ., Mich. Dept. of Civil Engineering.

GENERAL SOILS MODEL FOR SHOCK PROPAGATION STUDIES

C. X. C. F. Miranda and David C. Kraft (Dayton Univ.) *In* NRL Shock and Vibration Bull., No. 35, Pt. 5 Feb. 1966 p 321–328 refs Prepared jointly with Dayton Univ. (See N66-28686 16-32) CFSTI: HC $7.00/MF $1.75

A review is made of the currently accepted method for describing the one-dimensional stress–strain relationship for soils under shock loading. The implications of the currently accepted model for describing soil behavior are discussed with regard to its application to granular and cohesive soils. Based on experimental evidence presented, a new and more general model is proposed to represent the one-dimensional stress–strain relationship of all soils during locking behavior. The proposed model is a general one and can be used for shock propagation studies in soil media. Author

N66-28758# Naples Univ. (Italy). Inst. of Structural Engineering.

STATICS AND STABILITY OF THIN-WALLED ELASTIC BEAMS. PART I: FORMULATION OF FUNDAMENTAL EQUATIONS Final Report, Feb.–Jan. 1965

E. Giangreco, M. Capurso, and M. Como Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1966 65 p refs
(Contract AF 61(052)-813)
(AFFDL-TR-65-213, Pt. I; AD-480031)

Fundamental equations were formulated of elastic equilibrium of thin walled beams subject to general loads and dislocations starting only from the hypothesis of non-deformed transverse cross sections. Formulation was made of the fundamental equations of dynamic stability of thin walled

beams subject to general conservation loads and dislocations by use of a systematic geometrical approach.
Author (TAB)

N66-28843# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE CONSTRUCTION OF TWO-DIMENSIONAL EQUATIONS OF THE THEORY OF ELASTIC THIN PLATES
A. L. Gol'Denveyzer and A. V. Kolos *In its* Appl. Math. and Mech. 18 Feb. 1966 p 16–34 refs (See N66-28841 16-23)
CFSTI: HC $4.60/MF $0.50

The construction of an approximation theory to aid in designing thin elastic plates without the use of propositions of the Kirchhoff hypothesis type are discussed. The asymptotic method is applied to the problem of the general deformation of a thin plate, the average plane of which is referred to as an arbitrary orthogonal system of curvilinear coordinates. The problem is formulated and the partial differential equations are developed. It was found that the boundary conditions on the sides of the plate could be given with any desired degree of precision by taking a sufficient number of approximations and using arbitrary rules of integration. Illustrations are included, and variations are discussed. N.E.N.

N66-28970# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
CHEBYSHEV POLYNOMIAL APPROXIMATIONS FOR THE L-MEMBRANE EIGENVALUE PROBLEM
J. C. Mason Jan. 1966 28 p refs
(Contract AT(40-1)-3443)
(BN-428; TID-22529) CFSTI: HC $2.00/MF $0.50

A method is proposed for the solution of partial differential equations in terms of two-dimensional Chebyshev series. The method is a generalization of the "selected points" method described by Lanczos for solving ordinary differential equations. Some indications are given of the possible applications of the method, and it is applied in detail to a particular example, the eigenvalue problem for a vibrating L-shaped membrane. Author (NSA)

N66-29027# Oak Ridge National Lab., Tenn. Health Physics Div.
PROJECT SALT VAULT: EFFECTS OF TEMPERATURE AND RADIATION ON PLASTIC FLOW AND MINE STABILITY
R. L. Bradshaw, T. F. Lomenick, W. C. Mc Clain, W. J. Boegly, Jr., F. M. Empson et al [1966] 20 p refs Presented at Intern. Symp. on the Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash., 14–18 Feb. 1966 Submitted for Publication
(Contract W-7405-ENG-26)
(ORNL-P-2006) CFSTI: HC $1.00/MF $0.50

In mines in flat-lying salt deposits, heaving floors and sagging roofs can prove hazardous. The effects of temperature and load stress (in roof-supporting pillars) on such stability problems were studied by means of model pillars. Also, the effects of radiation (doses up to 5×10^8 R) on small test specimens were investigated. Operation of the radioactive and electrical arrays in Project Salt Vault did not reveal any significant effect of radiation on the salt flow or stability (as of January 1, 1966). However, thermal stresses from the heat in the floor were found to be transmitted to the roof, resulting in a fivefold increase in the rate at which the roof is sagging. No problems due to the increased flow are anticipated, either in the demonstration or in a properly designed actual disposal facility, but the need for careful study of such effects is underscored. Author (TAB)

N66-29079*# Bell Aerosystems Co., Buffalo, N. Y.
APOLLO LEM ADAPTER STRUCTURAL ANALYSIS Final Report, Jan. 1965–Apr. 1966
J. Padlog, W. Luberacki and R. H. Gallagher Apr. 1966 114 p refs *Its* Rept.-2286-950001
(Contract NAS9-3970)
(NASA-CR-65404) CFSTI: HC $4.00/MF $0.75 CSCL 20K

Results of a stress and deformation analysis performed on the Apollo LEM adapter for various design conditions are presented. Effects of both mechanical and thermal loads are included in the analysis. Particular attention is given to the determination of the reactions at the attachment points between the LEM and LEM adapter of the Apollo vehicle. Author

N66-29085*# Georgia Inst. of Tech., Atlanta. School of Engineering Mechanics.
THE AXISYMMETRIC RESPONSE OF A COMPLETE CYLINDRICAL SHELL TO SHOCK LOADS Progress Report
Wolfram Stadler and James Ting-Shun Wang [1965] 23 p refs
(Grant NsG-571)
(NASA-CR-75815) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The bending theory of thin shells is used to obtain the dynamic response of a complete cylindrical shell of finite length. The shell is subjected to axisymmetric dynamic loads, normal to the shell surface. The effects of the inertial load in the longitudinal direction are assumed to be negligible. The general solution is exact within the theory, and it is presented in a concise form, which simplifies its application to specific boundary-value problems. The natural frequencies are calculated from transcendantal equations obtained by the application of the respective boundary conditions to the general solution. An illustrative example of a clamped cylindrical shell subjected to a uniform shock with linear decay is presented, including numerical results. Author

N66-29158# Florida Univ., Gainesville. Dept. of Engineering Science and Mechanics.
NONLINEAR RESPONSE OF A THIN CONICAL SHELL TO DYNAMICALLY APPLIED AXIAL FORCE
John A. Wilder Mar. 1966 70 p refs
(Grant DA-ARO(D)-30-124-G372)
(AROD-3368-3; AD-631988) CFSTI: HC $3.00/MF $0.75

The response of a truncated conical shell to a dynamic axial force is studied by means of a large deflection analysis which includes the concept of initial imperfections. The derived governing nonlinear partial differential equations are reduced to nonlinear ordinary differential equations of a lower order by a first-approximation and the Galerkin method. For cones of moderate length, the solutions are found to be dependent on one physical and three geometric parameters. Numerical solutions to these equations are obtained by the Runge-Kutta algorithm and studies conducted to determine the effect of varying the pertinent parameters. It is found that the value of the load parameter in the region of instability and the number of longitudinal waves increase significantly for increased rates of loading. The results of varying the geometric parameters are in agreement with trends indicated in experimental data, but not predicted by previous theoretical analyses. Author (TAB)

N66-29160# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
TRANSVERSALLY ISOTROPIC CYLINDERS UNDER BAND LOADS
Howard S. Levine and Jerome M. Klosner Jan. 1966 34 p refs
(Contract Nonr-839(40) FBM)
(PIBAL-908; AD-631939) CFSTI: HC $2.00/MF $0.50

The problem of a transversally isotropic circular cylindrical shell subjected to periodically spaced axisymmetric band loads is investigated. The three-dimensional elasticity solution is obtained and stresses and displacements are evaluated for values of the modulus ratio equal to two, five and ten. Also presented are expressions for the stresses and displacements obtained by use of a thin orthotropic shell theory. The results are compared to determine the effects of a change in modulus ratio on the stresses and displacements of the cylinder and the accuracy of the shell theory. A detailed analysis of the data is carried out for a ratio of inner to outer shell radii equal to 0.70, a ratio of distance between band loads to outer shell diameter equal to 0.2., and a ratio of band width to distance between band loads of 0.2. Author (TAB)

N66-29172# Illinois Univ., Urbana.
INTERACTION OF PLANE STRESS WAVES WITH A SPHERICAL CAVITY IN ELASTIC AND VISCOELASTIC MEDIA
D. E. Allen and A. R. Robinson Feb. 1966 135 p refs *Its* Struct. Res. Series No. 302
(Contract Nonr-1834(03))
(AD-631501) CFSTI: HC $4.00/MF $1.00

Methods are given for the determination of stresses in the vicinity of a spherical cavity in an unbounded elastic or viscoelastic medium as a result of a step wave engulfing the cavity. Incident longitudinal and shear waves are considered. Two approaches are used for the solution. In the first, the solution is expressed in terms of generating functions which are determined from the boundary conditions at the cavity wall. For the elastic case, this method is analogous to the d'Alembert solution in one-dimensional wave propagation in which the general solution of the wave equation is used. The elastic case requires the solution of coupled systems of ordinary differential equations of initial value type. In the viscoelastic case, these are replaced by systems of integro-differential equations of Volterra type. Numerical methods are used for the solution of the equations. The second method proceeds by finding the Laplace transforms of the desired stresses and performing the inversions numerically. Viscoelastic materials represented by the Maxwell model and the standard linear model have been used for the computations presented. On the basis of these computations, conclusions are drawn concerning the effect of viscoelasticity of rock on the dynamic stress concentrations around a cavity in the rock making use of properties of rock determined for low stress levels. Author (TAB)

N66-29180# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THERMAL BENDING OF LONG THIN-WALL BOOMS DUE TO SOLAR DIFFERENTIAL HEATING IN NEAR-EARTH ORBITS
James E. Phenix Mar. 1964 51 p refs
(Contract NOw-62-0604-c)
(TG-559; AD-631822) CFSTI: HC $3.00/MF $0.50

Earth-orbiting radio astronomy satellites are currently receiving feasibility studies at APL/JHU. As part of these studies, thermal bending associated with solar and earth albedo heating of the proposed 1000-ft antennas has been examined. This report is intended to (1) Present the results of thermal bending analyses and experimentation. (2) Define the pertinent physical parameters affecting bending. (3) Recommend antenna configurations which will minimize thermal bending. TAB

N66-29199# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLUTION OF THE PROBLEMS OF FREE FLUCTUATIONS OF ANISOTROPIC DISCS
L. A. Movsisyan and V. S. Sarkisyan 15 Mar. 1966 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Fiz.-Mat. (Yerevan), v. 17, no. 4, 1964 p 43-50
(FTD-TT-65-890/1+2; AD-631766) CFSTI: HC $1.00/MF $0.50

In this work, a method of determining the natural frequency of free fluctuations of anisotropic discs is suggested which allows us to determine the natural frequencies in advance with any given precision in the limits of the classic theory of bending of discs. As a particular example, the problem of free fluctuations of a simple supported disc is examined. Author (TAB)

N66-29212*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A THEORY FOR INFLATED THIN-WALL CYLINDRICAL BEAMS
W. B. Fichter Washington, NASA, Jun. 1966 21 p refs
(NASA-TN-D-3468) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Nonlinear equilibrium equations are derived for the twisting, bending, and stretching of pressurized thin-wall cylindrical beams. Thin-wall beams, including those which depend on internal pressure for their load-carrying ability, appear to have application where lightweight structural members are required. Example problems involving column buckling and the bending of a beam column are solved with a set of linearized equations to illustrate the theory. The linearized equations reduce to the Timoshenko beam equations when internal pressure and axial force are set equal to zero. Author

N66-29250# General Dynamics/Convair, San Diego, Calif.
A METHOD FOR ESTIMATING THE FATIGUE LIFE OF 7075-T6 ALUMINUM ALLOY AIRCRAFT STRUCTURES
Clarence R. Smith Philadelphia, Pa., Naval Air Eng. Center, Dec. 1965 70 p refs
(Contract N156-41307)
(NAEC-ASL-1096; AD-632123) CFSTI: HC $6.00/MF $0.50

The purpose of this investigation was to assess the validity of the 'Smith Cumulative Damage' hypothesis for 7075-T6 aluminum alloy specimens and structures. It was found that the results of a single-amplitude test (at short life) can be used to estimate the stress at the point of failure, including residual stress. This permits using S-N data for axially loaded unnotched specimens to predict spectrum life. Excellent agreement was found between calculated and experimental lives of full-scale structures; however, test lives of small specimens were consistently shorter than predicted. Author (TAB)

N66-29292*# General Dynamics/Convair, San Diego, Calif.
CENTAUR TANK CORROSION TESTS AND X-RAYS
1 Aug. 1965 147 p refs
(Contract NAS3-3232)
(NASA-CR-72000; GD/C-BNZ-65-032) CFSTI: HC $4.00/MF $1.00 CSCL 20K

It is found that tank corrosion can be deterred or prevented by the following method; (1) elimination of the corrosive elements from the tank fabrication processes; (2) fabrication of the tank under stringently clean conditions, and the providing of protection from contamination during storage; and (3) the application of a corrosion inhibitor to the outside surfaces of the tank structure and to the parts and assemblies as early in the fabrication process as is compatible with manufacturing operations. The effectiveness of these measures was demonstrated by the low quantity of corrosion found on Centaur tanks 7D, 8D, and 9D. Author

N66-29305*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
THE BUCKLING OF CYLINDRICAL SHELLS Status Report No. 11
May 1966 10 p ref
(Grant NsG-18-59)
(NASA-CR-75830) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Shell stability and buckling of cylindrical and conical shells under axial compression loading and other stress deformations are discussed. The buckling of random-imperfection of cylindrical shells under axial compression loading is being investigated to ascertain the probabilities for reaching the state in which the rate of increase of longitudinal stress with respect to the average strain, or end shortening, vanishes. The statistical study is based on a deterministic solution of the problem assuming that the imperfections are given and then searching for the axial load which is either an absolute maximum or a relative maximum (the hypothetical cases where a maximum in the usual sense does not occur) with respect to the longitudinal average strain. Two approaches to the solution are being examined for the deterministic problem. The first, a conventional one, is based on double trigonometric series and the Galerkin procedure, or an energy method. The second, based or improper integral representations of the solution and leading to improper nonlinear integral equations, must be investigated further to verify its applicability. R.Ll.

N66-29334*# Consultants and Designers, Inc., Arlington, Va.
STABILITY OF AXIALLY SYMMETRIC DEFORMATIONS OF SPHERICAL SHELLS UNDER AXIALLY SYMMETRIC LOAD [OB USTOYCHIVOSTI OSESIMMETRICHESKIKH DEFORMATSIY SFERICHESKIKH OBOLO CHEK PRI OSESIMMETRICHESKIKH NAGRUZHENIYAKH]
A. V. Pogorelov Greenbelt, Md., NASA. Goddard Space Flight Center, Sep. 1963 6 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Teoriya Uprugosti (Moscow), v. 151, no. 5, 11 Aug. 1963 p 1053–1055
(Contract NAS5-2078)
(NASA-TT-F-8628; ST-SM-10050) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The stability of axially symmetric deformation of axially symmetric shells for two loading systems (concentrated force and uniform outer pressure) was investigated. Results indicate the following. (1) The bulging in the shape of a circle (at small deformations the bulging has the shape of a circle) under the action of a concentrated force is steady so long as the radius of this circle is $r \leq \sqrt{\delta R/c}$, where δ is the thickness of the shell and c is a constant ≈ 0.18. (2) The supercritical deformation of a spherical shell at uniform external pressure has an axial symmetry, i.e., the bulging region has the shape of a circle so long as the radius of the circle is the same as that given in (1). Following this, the bulging region begins to take the shape of a triangle with rounded-up apexes. I.v.L.

N66-29390*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME STUDIES ON THE NONLINEAR DYNAMIC RESPONSE OF SHELL-TYPE STRUCTURES
David A. Evensen and Robert E. Fulton [1965] 35 p refs Presented at the Conf. on Dyn. Stability of Struct., Evanston, Ill., 18–20 Oct. 1965
(NASA-TM-X-56843) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Nonlinear vibration, ann response of thin shells have been studied for (1) the forced, nonlinear flexural vibration of thin-walled circular cylinders; and (2) the dynamic axisymmetric snap-through buckling of shallow conical and spherical shells subjected to uniformly distributed impulsive pressures. Geometric nonlinearities, and bending modes are analyzed for a variety of boundary conditions. In the solution to the first problem, it was found that for certain frequencies of the driving force, only the driven mode responded; for other frequencies the companion mode also became excited due to nonlinear parametric coupling between the modes. Results given indicate that the nonlinearity for a cylindrical shell can be either of the softening or hardening type depending on the aspect ratio of the vibration mode. One comparison of data from the second problem shows that for conical caps a simply-supported shell can resist a larger impulse than a clamped cone. Another comparison between spherical and conical caps having the same height indicates that the sphere can resist a larger impulse than the cone before buckling. R.Ll.

N66-29406*# National Aeronautics and Space Administration, Washington, D. C.
THE DETERMINATION OF FREE VIBRATIONS OF LONGITUDINALLY-STIFFENED THIN-WALLED, CIRCULAR CYLINDRICAL SHELLS [EIGENSCHWINGUNGEN VERSTEIFTER KREISZYLINDERSCHALEN]
W. Schnell and F. Heinrichsbauer Apr. 1964 23 p refs Transl. into ENGLISH from German
(NASA-TT-F-8856) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Free vibrations of longitudinally stiffened, circular cylindrical shells are investigated according to the linear theory. The basic equations of vibrations of orthotropic circular cylinders are derived and methods of solution—continuous, blurred orthotropy; discontinuous, matrix method—are discussed. The method of conversion matrices takes into account the effect of discrete stiffening upon vibrational behavior. It permits development of equations of frequency in closed form and the simple determination of eigenforms. The results of theoretical investigations are compared with experimental values. Author

N66-29452*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATION OF SANDWICH PANELS IN A VACUUM
Clemans A. Powell, Jr. and David G. Stephens [1965] 29 p refs Presented at the 35th Shock and Vibration Symp., New Orleans, 25–28 Oct. 1965
(NASA-TM-X-56878) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The vibrational characteristics of sandwich panels over a wide range of pressures were determined. A panel excitation-support system, suitable for vacuum chamber application, was developed which provides a distributive vibratory loading as well as free-edge conditions. Natural frequencies and damping coefficients were determined for several modes of vibration at pressure levels from 1 atmosphere to 10^{-6} torr. Results indicate that classical plate theory utilizing a finite difference method of solution is applicable for obtaining frequencies and mode shapes of sandwich panels except for extremely low core stiffness. A decrease in pressure results in an increase in frequency from 2 to 10 percent due to changes in core properties and apparent mass effects. A decrease in pressure also results in a linear decrease in damping due to the reduction in acoustic radiation. The damping coefficients are essentially independent of the amplitude of vibration. Author

N66-29500# Royal Aircraft Establishment, Farnborough (England).

A REVIEW OF THE WORK IN THE UNITED KINGDOM ON THE FATIGUE OF AIRCRAFT STRUCTURES DURING THE PERIOD MAY 1963-APRIL 1965

E. L. Ripley and R. D. J. Maxwell Aug. 1965 28 p refs Presented at Conf. of Intern. Comm. on Aeron. Fatigue, Munich, Jun. 1965

(RAE-TR-64193) CFSTI: HC $2.00/MF $0.50

This paper was given before the Conference of the International Committee on Aeronautical Fatigue. It surveys briefly the work on fatigue of aircraft structures and provides a useful reference list of papers issued on this subject. Author

N66-29545*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.

STABILITY OF CYLINDRICAL SHELLS UNDER AXISYMMETRIC MOVING LOADS

G. A. Hegemier May 1966 83 p refs

(Grant NsG-18)

(NASA-CR-75893) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Using a Donnell-type nonlinear theory and the stability in the small concept of Poincaré, the stability of an infinite-length cylindrical shell subjected to a broad class of axisymmetric loads moving with constant velocity is studied. Special cases of the general loading function include the moving ring, step, and decayed-step loads. The analysis is carried out with a multiple Laplace transform-functional difference technique. Numerical results are presented for the moving ring and decayed step load cases. A strong dependence of stability on load velocity is found. Author

N66-29548# Aerojet-General Corp., Sacramento, Calif. REON Div.

METALLURGICAL INVESTIGATION OF HYDROGEN PREHEATER TUBE FAILURE

D. J. Lamuermeyer Mar. 1966 38 p refs

(RN-TM-0312)

An investigation was conducted to determine (a) the cause of gaseous hydrogen preheater tube failure, (b) extent of damage from overheating, and (c) actions necessary to qualify the preheater for operation. The primary fracture was caused by zinc contamination, which penetrated the grain boundaries under elevated temperature conditions. Cracks were progressively formed causing reduction of tube wall thickness and rupture. Overheating damage was indicated by measuring the OD of all tubes, and revealed that tubes numbered 31 through 40 and 99 in the north arch were bulged. The remaining tubes were not adversely affected by the overheating as evidenced by satisfactory elevated and room temperature tensile, sensitization, degradation, and bulge test results. Recommendations were made to (a) inspect all tubes by shear-wave ultrasonic tests for detection of cracks prior to the initial test run and periodically there-after, (b) proof and leak test and preheater at a pressure equivalent to one-half of the material yield strength, and (c) independently support the sine-wave spacers to prevent sagging during future heater operations. Author

N66-29567*# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.

THE INFLUENCE OF THE TESTING MACHINE ON THE BUCKLING OF CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION

Charles D. Babcock, Jr. May 1966 25 p refs

(Grant NsG-18)

(NASA-CR-75883) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A series of experiments has been carried out on electroformed cylindrical shells under axial compression to determine the effect of the stiffness of the testing machine on the buckling loads. In addition, the effect of the testing machine has been calculated using an energy criterion. It is shown that the calculated energy load has a strong dependence on the testing machine while the experimental data is virtually independent of the testing machine stiffness. Author

N66-29756*# Ryan Aeronautical Co., San Diego, Calif.

DEPLOYABLE LARGE AREA SOLAR ARRAY STRUCTURE Final Design Report

5 May 1966 256 p refs Prepared for JPL *Its* Rept.-20869-2

(Contracts NAS7-1000; JPL-951107)

(NASA-CR-76048) CFSTI: HC $6.00/MF $1.50 CSCL 22B

The results of design activities for a prototype deployable large area solar array structure are summarized. A functional description of the major elements of the array is included along with a discussion of the proposed installation of the array to a hypothetical spacecraft. The structural and thermal characteristics of the design are compared with design requirements. It is reported that the calculated structural weight based on substrate unit area, reflects a design which is based on controlled tolerance sheet thicknesses, reliability in fulfilling mission requirements, and the use of present state-of-art materials. Supporting technical data is included. H.S.W.

N66-29789# RAND Corp., Santa Monica, Calif.

ON THE EFFECTS OF SOURCE PROXIMITY ON THE DYNAMIC STRESSES AROUND A CYLINDRICAL CAVITY

M. T. Jakub and C. C. Mow Apr. 1966 48 p refs

(Contract AF 49(638)-1700; Proj. RAND)

(RM-4893-PR; AD-631773) CFSTI: HC $4.60/MF $0.50

An analysis is presented and numerical results are given of the interaction of a cylindrical wave impinging on a cylindrical cavity. It is assumed that a line source is located at an arbitrary distance from the cavity and that its strength varies harmonically in time. The resulting dynamic-stress-concentration factors around the cavity were determined by considering the wave-diffraction effects around the cavity. Numerical results indicate that the dynamic-stress-concentration factors around the cavity are dependent upon (1) distance from the

source to the cavity, (2) wave numbers, and (3) the Poisson ratio of the medium. It is also shown that at high wave number (high frequency) the cylindrical-incident-wave problem becomes almost identical to the plane-wave problem; however, at low wave number, the solution presented in this memorandum departs drastically from all previous investigations where the incident wave is assumed to be a plane wave. Stress-concentration factors as much as 66 percent higher than those determined in earlier studies were noted in the present analysis. Author (TAB)

N66-29827# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

RESPONSE OF HORIZONTALLY ORIENTED BURIED CYLINDERS TO STATIC AND DYNAMIC LOADING Final Report, Feb. 1964–May 1965

Albert Francis Dorris (Ph.D. Thesis—Illinois Univ.) Jul. 1965 222 p refs Sponsored by DASA Available from Army Engr. Waterways Expt. Station, Vicksburg, Miss.: HC $3.00; CFSTI: MF $1.25

(TR-1-682; AD-621340)

This was an experimental investigation into the response of small, shallow-buried (in dense, dry sand and stiff clay), aluminum cylinders to static (15-min rise time), rapid (13 msec), and dynamic (0.3 msec) plane-wave loading up to 500 psi. The cylinders had identical outside diameters of 3.5 and two thicknesses, 0.022 and 0.065 in. Hence, the cylinder stiffnesses, EI/CuR, were 1.7 and 45 (d/t = 159 and 54), respectively. In stiff clay, the overpressure required to cause collapse increased very slowly with increasing depth of burial from zero to the deepest burial, three-quarters of the diameter. The hydrostatic buckling equation, Pcr = 3 EI/CuR, was applicable for the cylinders tested. In the dense sand, the overpressure required to cause collapse increased greatly with increasing depth of burial from zero to one-eighth of the diameter. Below this depth it was not possible to collapse even the most flexible cylinders under the available 500-psi pressure. The hoop compression theory was verified. A ductility factor of about 7 was found to be conservative for cylinders buried at depths greater than one-eighth their diameter in the dense sand. The recorded strains were nonelastic in many cases and it was shown that large yielding does not necessarily define collapse. Stress and moment were found to be nonlinear functions of overpressure, whereas thrust was generally found to be a linear function of overpressure. The differences between static and rapid loading in the elastic response of the cylinder were found to be small. Author (TAB)

N66-29829# Explosives Research and Development Establishment, Waltham Abbey (England).

A MECHANISM FOR THE CONTROL OF CRACK PROPAGATION IN ALL-BRITTLE SYSTEMS

J. Cook and J. E. Gordon Feb. 1965 19 p refs Repr. from Proc. Roy. Soc. (London), Ser. A, v. 282, 1964 p 508–520 /ts Offprint No. 65/2

(AD-619199)

The stress distribution close to the tip of a crack which has a finite tip radius and which is being opened either by means of a remotely applied tension field $\sigma_{y,0}$ or by means of a concentrated force (e.g. a wedge driven into the crack) has been computed. It is shown that there exist tensile stresses σ_x parallel to the plane of the crack and ahead of the crack tip. The maximum value of the tension σ_x is an approximately constant fraction ~ 1/5 of the peak stress concentration $\sigma_{y,max}$ which usually causes crack propagation. Inside a brittle solid, if a plane of weakness or potential cleavage is present and is roughly normal to the plane of the original crack, this interface may break and produce a secondary crack in such a manner as to interfere with the progress of the primary crack. If the ratio of the adhesive strength of the interface to the general cohesive strength of the solid is in the right range large increases in the strength and toughness of otherwise brittle solids may result. Author (TAB)

N66-29852# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

VARIATIONS OF FREELY-SUPPORTED ORTHOTROPIC CYLINDRICAL SHELLS UNDER INTERNAL PRESSURE

Peter R. Di Giovanni and John Dugundji Feb. 1965 78 p refs

(Grant AF-AFOSR-62-363)

(AFOSR-65-0640; ASRL-TR-112-4; AD-617269) CFSTI: HC $3.00/MF $0.75

The influence of orthotropicity and internal pressure on the natural frequencies of a thin cylindrical shell whose ends are freely supported is found using the shell equations of Washizu. Other common shell theories are also presented. Calculations are performed for four constant thickness orthotropic cylinders, two stiffened cylinders, and a basic isotropic cylinder. For these calculations, only the special cases of axial and circumferential stiffening were considered. TAB

N66-29853# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

VARIATIONAL PRINCIPLES IN THE LINEAR DYNAMIC THEORY OF VISCOELASTICITY

Marshall J. Leitman Apr. 1965 24 p refs

(Contract Nonr-562(10))

(TR-98; AD-615322) CFSTI: HC $2.00/MF $0.50

In a recent paper, Gurtin deduces variational principles which characterize the standard initial-value problems of linear elastodynamics. This paper extends these principles to dynamic viscoelasticity theory. Author (TAB)

N66-29882# Rocketdyne, Canoga Park, Calif.

A FUNDAMENTAL SET OF DISPLACEMENT FUNCTIONS FOR AXIALLY SYMMETRIC ANISOTROPY FOR MATERIALS WITH SEVEN OR FEWER ELASTIC CONSTANTS

H. A. Lang 20 May 1966 55 p refs Presented at 5th U.S. Natl. Congr. of Appl. Mech., Minneapolis, 14–17 Jun. 1966

(RR-66-6)

The classical isotropic theory for describing the symmetrical deformations of circular cylinders, circular tubes or circular holes in an infinite medium depends upon four (linearly independent) modified Bessel functions. These functions determine the radial variation of stresses and displacements. The functions are always the solutions of an ordinary fourth order differential equation which factors into two equal commutative factors. The fourth order equation may determine a stress function, or either the radial or axial component of displacement. The four linearly independent functions for the axial displacement are slightly simpler than those for the radial component. Author

N66-29884# Illinois Univ., Urbana.

FLEXURAL ANALYSIS OF ELASTIC-PLASTIC RECTANGULAR PLATES

Leonard A. Lopez and A. H.-S. Ang May 1966 130 p refs /ts Civil Eng. Studies Structural Res. Ser., No. 305
(Grants NSF GP-984; NSF GK-589)

A numerical technique is developed by which approximate solutions can be obtained for load-deformation characteristics of a rectangular plate subjected to loads ranging from zero to the ultimate capacity of the plate. A mathematically consistent lumped parameter model is used, in which stresses, strains, and displacements are defined at discrete points. Problem analysis is restricted to sandwich plates consisting of a shear core between two thin sheets. The material in the outer sheets follows the stress–strain law for a Prandtl–Reuss solid. Four problems of uniformly loaded square plates are presented with different boundary conditions; and techniques for solving these problems are discussed in detail. The problem of convergence is studied on a heuristic basis. Results of the investigation show that a sequence of solutions determined with decreasing mesh lengths of the model tend to a unique solution. S.P.

N66-29893# David Taylor Model Basin, Washington, D. C.
AXISYMMETRIC STRESSES IN ORTHOTROPIC, WEB-STIFFENED SANDWICH CYLINDERS LOADED WITH UNIFORM EXTERNAL PRESSURE
James A. Nott Apr. 1966 35 p refs
(DTMB-1859; AD-632606) CFSTI: HC $2.00/MF $0.50

An analysis is developed for determining stress distributions in orthotropic, web-stiffened sandwich cylinders loaded with external uniform pressure. This analysis is particularly applicable to sandwich pressure hulls for deep-diving submarines, which are constructed with glass-reinforced plastics. The separate values of Poisson's ratio and Young's modulus along the three principal orthogonal axes of the cylinders are used in the equilibrium equations. Graphs are presented to enable rapid determination of hyperbolic and trigonometric stress coefficients. Author (TAB)

N66-29899# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL SOLUTION OF A SYSTEM OF DIFFERENTIAL EQUATIONS—APPLICATION OF THE METHOD TO THE CALCULATION OF A ROTATION SHELL
M. Sh. Mikeladze 29 Apr. 1966 12 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 17, no. 3, 1953 p 382–386
(FTD-TT-65-1439/1+4; AD-632286) CFSTI: HC $1.00/MF $0.50

A numerical solution is presented for a system of linear differential equations with variable coefficients applicable to systems. The method of Sh. Ye. Mikeladze is used. The entire calculational process consists of using simple recurrent ratios which in contrast to the final differential method avoids solving cumbersome algebraic systems. The method is applied to the problem of a rotating shell of variable thickness. R.N.A.

N66-29911*# Autonetics, Anaheim, Calif. Data Systems Div.
STUDY OF STRUCTURAL BENDING ADAPTIVE CONTROL TECHNIQUES FOR LARGE LAUNCH VEHICLES Technical Summary Report, Volume I
16 Mar. 1966 59 p refs
(Contract NAS8-20056)
(NASA-CR-76056; C6-673/33) CFSTI: HC $3.00/MF $0.50
CSCL 22D

This report summarizes the results of applying a spectral identification adaptive control system to a realistic large launch vehicle in a complete closed loop trajectory simulation with bending frequencies changing and initial frequency uncertainties. Results of stability and trajectory analyses are included as well as modifications to the basic spectral identification system needed to satisfy system requirements. Stability analyses results are given in the form of gain-phase plots performed for three flight cases: lift off, maximum dynamic pressure, and end of first stage after launch. Satisfactory stability was achieved for all cases with the spectral identification system operative. Trajectory results cover the complete first stage and show the dynamic behavior of the identification system and vehicle ability to follow the trajectory in the presence of atmospheric disturbances and instrument noise. Results indicate the system capability to provide stable vehicle control with wide margins of uncertainty in the vehicle dynamic and flexibility coefficients. R.N.A.

N66-29912*# Autonetics, Anaheim, Calif. Data Systems Div.
STUDY OF STRUCTURAL BENDING ADAPTIVE CONTROL TECHNIQUES FOR LARGE LAUNCH VEHICLES Technical Summary Report, Volume II
Mar. 16 1966 330 p refs
(Contract NAS8-20056)
(NASA-CR-76055; C6-673/33) CFSTI: HC $7.00/MF $1.75
CSCL 22D

Results are presented of a study of structural bending adaptive control techniques for large launch vehicles. The system studied uses the principles of spectral identification to identify vehicle dynamics and the identified vehicle parameters to compute the required control compensation for proper system performance and stability. Computations are performed digitally and the functions of identification/compensation are performed continuously during vehicle operation. Emphasis was placed on the problem of decoupling the elastic modes and the rigid mode of a large Saturn booster. Problems associated with active bending control using a single force point for control were also investigated. Stability analyses results are given in the form of gain-phase plots performed for three flight cases (8, 78, and 157 sec after launch). Satisfactory stability was achieved for all cases with the complete spectral identification system operative. Trajectory results cover the complete first stage and show dynamic behavior of the identification system and the vehicle ability to follow the trajectory in the presence of atmospheric disturbances and instrument noise. Results indicate the system capability to provide stable vehicle control with wide margins of uncertainty in the vehicle dynamic and flexibility coefficients. R.N.A.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-28588# Radio Corp. of America, Princeton, N. J.
COMPUTER ANALYSIS OF SATELLITE THERMAL BEHAVIOR
R. H. Goerss *In* RCA, Camden, N. J. Computer Progr. [1965] p 38–41 (See N66-28586 16-08)

The computation and prediction of spacecraft thermal behavior is necessary to assure successful equipment operation. Mission parameters governing spacecraft thermal characteristics, such as those described in this paper, are evaluated by digital-computer analysis. Various AED digital-computer programs, their results and some possible future additions are described herein. Author

N66-28727# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
TWO-DIMENSIONAL HIGH SPEED FLOW OF RADIATING GAS
Prem K. Khosla Feb. 1966 38 p refs Presented at the Symp. on Interdisciplinary Aspects of Radiative Energy Transfer, Philadelphia, 24–26 Feb. 1966
(Contract Nonr-839(34))
(PIBAL-956; AD-481002)

In high speed gas dynamics the analysis of two-dimensional flows of hot gases where the effect of radiation as a mode of energy transfer cannot be neglected, is extremely difficult due to the integro-differential nature of the governing equations. To date, most of the existing literature on radiation gas dynamics is confined to the study of two asymptotic cases of thin or thick gas. For arbitrary optical properties, the integro-differential equations can be reduced to partial differential equations by applying the differential or the so-called Milne–Eddington approximation, which is well-known in astrophysical literature, in the case of supersonic flows even this approximation does not allow the use of the methods already developed for nonradiating gaseous flows where the equations are hyperbolic in nature. This paper deals with certain flow situations where two characteristic lengths are available in the system. An order of magnitude analysis, based on two lengths and the mean free path of radiation, has been carried out and the basic equations of the flow have been simplified to the equations that are parabolic in character. This (after applying the Milne–Eddington approximation) is then applied to the supersonic flow past a wavy wall. Within the parametric range of the applicability a comparison of the results of the present investigation with the exact known results of Cheng shows good agreement. TAB

N66-28945# Minnesota Univ., Minneapolis.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF LAMINAR FILM CONDENSATION OF A SATURATED AND SUPERHEATED VAPOR ON A SURFACE WITH A CONTROLLED TEMPERATURE DISTRIBUTION
Donald Lee Spencer (Ph.D. Thesis) Ann Arbor, Mich., Univ. Microfilms, Jun. 1965 167 p refs

The object of this work is to carry the development forward by experimental verification of a recently developed theory concerning the effects of superheat on laminar film condensation. Further, an attempt is made to make measurements with greater precision than has been done in the past. New techniques were developed which enable the determination of local, rather than over-all coefficients. Experiments were run for comparative purposes using a saturated vapor. The theoretical part of this study involves interfacial stability. A stability analysis is made for a vertical, smooth, condensing surface with zero interfacial shear stress. The results indicate free surface instability, and add to the theoretical complexity of vertical laminar film condensation. Author

N66-28977# Oak Ridge National Lab., Tenn.
PRESSURE DROP WITH FORCED-CONVECTION BOILING OF POTASSIUM
R. P. Wichner and H. W. Hoffman [1965] 14 p refs Presented at the 4th High Temperature Liquid-Metal Heat Transfer Technol. Conf., Argonne, Ill., 28–29 Sep. 1965
(Contract W-7405-ENG-26)
(ONRL-P-1681; CONF-650946-4) CFSTI: HC $1.00/MF $0.50

Results are given for the pressure drop with boiling potassium in forced-convection flow through a vertical, circular tube. The data, which comprise a single series of measurements (Series D), were obtained in a 6-ft long×0.270-in.-ID tube having pressure taps at 1-ft spacings over the final 4 ft of the channel. The pressure-measurement system and its deficiencies are discussed; the primary difficulty appears to be "aging" of the diaphragms in the pressure transmitters over long exposure times at high temperatures. The pressure distribution along the boiler was estimated using both homogeneous and Lockhart–Martinelli descriptions of the flow; the calculated exit pressures compared favorably with the measured values. Author (NSA)

N66-28993# Los Alamos Scientific Lab., N. Mex.
ON FREQUENCY DISCRETIZATION AND CONSERVATIVE DIFFERENCE EQUATIONS FOR RADIATIVE TRANSFER
Burton Wendroff 20 Sep. 1965 18 p refs
(Contract W-7405-ENG-36)
(LA-3401) CFSTI: HC $1.00/MF $0.50

The method of characteristics is generalized to obtain completely conservative difference equations that are approximations to the transport equation. A method of frequency discretization, which allows retention of a large part of the information that is lost if the absorption coefficient is simply averaged, is proposed. It is shown that the difference equations behave correctly in the limit of large or small absorption coefficient. Author (NSA)

N66-29033# Rutgers Univ., New Brunswick, N. J. Div. of Reactor Development.
THE MOTION OF SMALL PARTICLES IN NON-UNIFORM TEMPERATURE FIELDS
H. A. Dwyer (Ph.D. Thesis) Feb. 1966 90 p refs *Its* Tech. Rept.-107-ME-F
(Contract AT(30-1)-2930)
(NYO-2930-5) CFSTI: HC $3.00/MF $0.50

A study of the effects of temperature gradients on the motion of small particles in both gases and liquids was undertaken to obtain the equations needed to determine the thermal forces. It is shown that the particle in a gas and the particle in a liquid problem are fundamentally different, and that nonrelated methods had to be used to obtain solutions. A system of equations covering the entire range of Knudsen numbers was developed to explain the thermal force experienced by a particle in a gas. For a particle in a nonuniform temperature liquid the Brownian motion solution of Chandrasekhar was extended to include the effects of the nonuniform temperature. A linearized version of Grad's Thirteen Moment equations was solved with generalized velocity slip and temperature jump boundary conditions to obtain a theory of the thermal force on a spherical particle in a gas. The theory is in good general agreement with all experimental data over the entire range of Knudsen number variation, and gives the correct dependence on the thermal conductivity of the particle. For a

large Knudsen number (transition regime) the solution is functionally the same as L. Waldmann's and in the free molecular regime it agrees with Knudsen's experimental results. As a by-product of the theory, thermal accommodation coefficients can be predicted with fair to good accuracy. For particles with high thermal conductivities and high accommodation coefficients the theory also predicts the possibility of a reversal to the thermal force in the near continuum limit. This reversal of thermal force is a result of normal stresses on the particle caused by normal heat transfer. The motion of a particle in a nonuniform temperature liquid was solved by modifying Chandrasekhar's Brownian motion solution. The solution to the nonuniform temperature problem was obtained in terms of a Gaussian distribution with a time and space dependent standard deviation for both velocity and position. From this Gaussian probability distribution the root mean square dispersion can be found, since by definition it is the same as the standard deviation. For a linear variation in the liquids temperature the Brownian particle root mean square dispersion was found to be constant in time, and no Brownian particle mean thermal motion was predicted. It seems from the analysis that in order to have a Brownian particle mean thermal motion a nonsymmetric transition probability for the random thermal force would have to be introduced. In the case of a quadratic temperature field the Brownian particle root mean square dispersion increased or decreased, respectively, as the Brownian particle moved from its initial position. Again, no Brownian particle mean thermal motion was predicted. Time dependent temperature field Brownian particle solutions were obtained for arbitary temperature variation.

Author (NSA)

N66-29058# California Univ., Berkeley.
DYNAMIC RESPONSE OF A DUAL-HEAT-EXCHANGER SYSTEM Final Report
Y. Takahashi and H. Thal-Larsen May 1965 188 p refs
(Contract AT(11-1)-34)
(UCB-34P64-1) CFSTI: HC $5.00/MF $1.00

Research work on different aspects of the dynamic behavior of a dual-heat-exchanger system is presented in six separate sections. In (1) the temperature interaction between a flowing fluid and the confining metal pipe is investigated. In (2) the research is directed at learning how oscillatory fluid-temperature transients are produced. (3) It is shown that the centerline velocity of the fluid has an appreciable effect on fluid-temperature transients. (4) A theoretical analysis is made of the dual heat exchanger on the basis of a linear stationary distributed-parameter system. The formulation of the system on the basis of a lumped approximation is undertaken in (5), as this allows the theoretical analysis to be expressed in the context of a state vector. Finally, in (6), an attempt is made to unravel the problems associated with optimal control. NSA

N66-29134# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
TRANSIENT TEMPERATURES OF THIN PLATES AND SHELLS RADIATING IN A VACUUM
D. F. Winter Mar. 1966 14 p refs
(D1-82-0509; AD-631710) CFSTI: HC $1.00/MF $0.50

When certain conditions are satisfied, radiative exchange predominates over other modes of heat transport within evacuated arrays of thin parallel plates, concentric cylindrical, or spherical shells. The system of equations which provides the transient temperature of each plate or shell of such an array is displayed. Approximate analytic solutions are presented for small values of time for the case of uniform initial temperature. A steady-state solution is also presented, together with certain numerical results for general values of time. The temperature histories of such arrays may serve to indicate the character of the temperature response of more complex evacuated particulate media in which radiative transport of heat energy predominates. Such a situation may prevail in the case of certain planetary and satellite surfaces. Author (TAB)

N66-29139# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME DATA ON THE EFFECT OF ADDED OXYGEN ON HEAT EMISSION AS SODIUM FLOWS THROUGH A COOLED PIPE
A. S. Andreyev, Ye. D. Fedorovich, and A. V. Shchedrin 23 Mar. 1966 12 p refs Transl. into ENGLISH from Zhidkie Metal., Sb. Statei (Moscow), 1963 p 109–113
(FTD-TT-65-1511/1+2+4; TT-66-61103; AD-631581) CFSTI: HC $1.60/MF $0.50

The solving of the problem of contact thermal resistance which was discovered in working with liquid-metal heat carriers, particularly with alkali metals, to a great extent determines the effectiveness and dependability of heat-exchange equipment. The presence of contact resistance outwardly reveals itself in the lowering of the coefficient of heat emission as compared with the theoretical values, and also in the instability of the heat exchange in time. Work was carried out for the purpose of obtaining data on the effect on the extent of this contact resistance on temperature conditions and its relationship to relative content of oxygen in the sodium. The results of the experiments indicate that the cause of the phenomenon of contact thermal resistance on a cooled surface is the admixture of sodium oxide deposited from the liquid metal. TAB

N66-29152# RAND Corp., Santa Monica, Calif.
ONSET OF THERMAL INSTABILITY IN A HORIZONTAL CIRCULAR CYLINDER
Michael Sherman Apr. 1966 30 p refs
(Contract AF 49(638)-1700)
(RM-4820-PR; AD-631960) CFSTI: HC $2.00/MF $0.50

The classical Rayleigh thermal-stability problem of an infinite horizontal fluid layer heated from below is extended to the case of a fluid confined within a rigid, horizontal circular cylinder whose wall is nonuniformly heated. The temperature distribution on the wall is specified such that in the quiescent state, a constant temperature gradient in the fluid is established in the direction of the body force. The governing perturbation equations form a self-adjoint eigenvalue problem for the critical Rayleigh number (the stability criterion). Two different variational principles are presented, each equivalent to the eigenvalue problem. Using these principles, two approximate methods are developed for calculating upper bounds to the critical Rayleigh number. It is found that the critical Rayleigh number for the cylindrical configuration (based on a unit diameter) is about 3.8 times that for the horizontal-layer configuration (based on a unit height). The value for the cylinder is considerably lower than values calculated in previous analyses. Author (TAB)

N66-29203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE PROCESS OF EXPANSION OF FREON-12 IN A NOZZLE

T. M. Sutyrina 15 Mar. 1966 9 p refs Transl. into ENGLISH from Kholodil. Tekhn. (Moscow), no. 4, 1964 p 45–51 (FTD-TT-65-1033/1+2; AD-631769) CFSTI: HC $1.00/MF $0.50

The results are presented of an experimental study of the flow process of expanding Freon 12 in an nozzle. The changes of basic parameters along a nozzle during the isoentropic equilibrium process of expansion of Freon were calculated and are shown. Coefficients were obtained which were used to determine all nozzle parameters for calculating the equilibrium conditions in the final sections of the nozzle. This condition is fulfilled for the saturated initial state of Freon with the nozzle length not exceeding 200 mm and for the supercooled initial state of Freon with the nozzle length not exceeding 450 mm. R.N.A.

N66-29225*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

FLAMMABILITY DURING WEIGHTLESSNESS

John Howard Kimzey May 1966 17 p refs Presented at 12th Ann. Tech. Meeting of the Inst. of Environ. Sci., San Diego, Calif., 13 Apr. 1966

(NASA-TM-X-58001) CFSTI: HC $1.00/MF $0.50 CSCL 21B

Experiments were conducted to determine the effects of weightlessness on a flame. The experiments were conducted in flammability chambers onboard a KC-135 aircraft equipped for weightless flight and motion pictures were taken of the burnings. Styrene, white foam rubber, paraffin, neoprene, silicone rubber, Teflon, polyurethane, and dacron-wrapped polyurethane were used as fuels in atmospheres of pure oxygen, air, and other oxygen–nitrogen mixtures. The tests showed that ignition during weightlessness is essentially unchanged as compared with ignition under lg. Burning rates are reduced to approximately one-tenth of an inch per second. Self-extinguishment can take place for some fuel–atmosphere systems. Introducing an acceleration renews convection promptly. A gas interface exists at the edge of the corona. This implies a phenomenon analogous to surface tension, with characteristics varying according to the presence of inert gases. R.N.A.

N66-29291*# General Dynamics/Astronautics, San Diego, Calif.

ENVIRONMENTAL CONTROL STUDY OF SPACE VEHICLES. PART III: THERMAL CONTROL TECHNIQUES AND SYSTEMS

J. C. Ballinger and E. H. Christensen 31 Dec. 1960 125 p refs

(NASA-CR-72005; GD/A-ERR-AN-051) CFSTI: HC $4.00/MF $1.00 CSCL 20M

A general analysis of thermal control systems is presented. Conventional and more revolutionary thermal control systems are discussed with respect to the external thermal environments which may be encountered. Equations are developed to define the systems within the scope of a general report. Particular thermal control systems are analyzed for application on representative present and future missions, with an attempt to arrive at systems which will optimally accomplish the thermal control aspects of particular missions. Conclusions are drawn with respect to the type of thermal control system for use on particular missions. Author

N66-29346*# General Dynamics/Astronautics, San Diego, Calif.

FREEZING OF CRYOGENIC LIQUIDS WHEN EXPANDED TO PRESSURES BELOW THE TRIPLE POINT PRESSURE

G. M. Holmstead 27 Aug. 1963 63 p refs (Contract NAS3-3232)

(NASA-CR-60325; GDA/A-63-0832) CFSTI: HC $3.00/MF $0.75 CSCL 20M

This report documents two experimental studies. The first is concerned with photographically recording the freezing phenomena associated with an expansion to pressures below the triple point using various mockups of actual Centaur hardware. The second study deals with flow characteristics of liquid hydrogen and nitrogen through simulated micrometeorite punctures in 0.010-in thick stainless steel into a pressure environment below the triple point pressure. The coefficient of discharge associated with incompressible ideal fluid flow was measured and the effect of liquid freezing on the flow was evaluated. Results of each study are given independently. Most of the results were obtained via high speed 16 mm movie film. A listing of the film record and its location is given for each test block. Specific scenes are included to give an indication of what is contained in the film record. A thermodynamic analysis was made of the freezing phenomena to provide quantitative concurrence with that which was observed. The appendix contains the analysis along with development problems encountered with the micrometeorite puncture leakage study test fixtures. Author

N66-29356*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENERGY TRANSPORT BY THERMAL, FIELD EMISSION

James F. Morris 19 Jul. 1965 14 p refs Submitted for Publication

(NASA-TM-X-56751) CFSTI: HC $1.00/MF $0.50 CSCL 20M

This paper gives theoretic evaluations of heat transfer caused by electron emission opposed by a barrier that terminates at the Fermi level on the emitter surface. For these predictions electric fields vary from 10^6 to 10^8 V/cm, work functions range from 1 to 8 V, and emitter temperatures span from 0 to 3000°K. Current density J and cooling voltage ΔV_c show graphically the trends of emitter cooling ($\Delta Q_c = J\Delta V_c$); in addition, ΔQ_c, J, and ΔV_c appear in tables. Because true transport rates for thermal, field emission probably exceed these estimates (up to 10^9 W/cm^2), high fields provide powerful processes for heating and cooling. Author

N66-29384*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONTINUOUS SKIN CONSTRUCTION TECHNIQUE FOR FABRICATING MODELS FOR AERODYNAMIC HEAT-TRANSFER STUDIES INVOLVING VERY SMALL TRANSIENT HEATING RATES

William D. Harvey [1965] 19 p refs Presented at the Instr. Soc. of Am. 20th Ann. ISA Conf. and Exhibit, Los Angeles, 4–7 Oct. 1965

(NASA-TM-X-56770) CFSTI: HC $1.00/MF $0.50 CSCL 20M

A satisfactory technique has been developed which allows simple or complicated shapes to be heavily instrumented for the purpose of measuring either small or large temperature rises for very short test times during aerodynamic heating investigations conducted in the Langley hotshot tunnel. The basic technique consists of attaching a continuous thin sheet (0.002 in. thick) to a supporting surface (model body geometry) through which a series of holes of known shape have been drilled. When thermocouple wires (chromel-alumel wires of 0.001-inch diameter) are attached to the thin sheet through the drilled holes, each disk of material serves as an individual calorimeter which is capable of rapid response to sudden but

small temperature changes. This method of instrumentation has proven to be a durable and satisfactory technique.
Author

N66-29430*# Alabama Univ., University. Bureau of Engineering Research.
THE STUDY OF TRANSIENT HEAT TRANSFER PROBLEMS Quarterly Progress Report VI, 1 Jun.-31 Aug. 1966
Raymond M. Hollub 31 Aug. 1966 14 p
(Contract NAS8-5217)
(NASA-CR-57810) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The design, fabrication, and calibration of an intermediate range high temperature hot gas facility were completed. The hot gas test facility was operated and calibrated. Heat transfer from the calorimeter test section by conduction through the thermocouple leads and through the insulation was measured and calibrated with respect to free stream velocity and pressure. The 2 1/2-in calorimeter test assembly was calibrated for all test geometries to be examined. Experimental heat transfer data were collected with the 2 1/2-in calorimeter for geometric configuration 1. Geometric configurations 2 and 3 were fabricated and test data is being collected. A calorimeter block assembly was fabricated in geometric configurations 2 and 3 for the hot gas facility. Heat transfer data is being prepared for computer reduction. A transparent calorimeter test section was substituted in the 2 1/2-in calorimeter test facility for configuration 1. Flow visualization studies reveal the development of a vortex along the length of the calorimeter section.
R.N.A.

N66-29465*# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
A THEORETICAL STUDY OF NONLINEAR TRANSVERSE COMBUSTION INSTABILITY IN LIQUID PROPELLANT ROCKET MOTORS
Ben T. Zinn May 1966 295 p refs *Its* Tech. Rept.-732
(Contract NASr-217)
(NASA-CR-75894) CFSTI: HC $6.00/MF $1.50 CSCL 20M

The nonsteady flow conditions inside the subsonic section of a Laval nozzle have been considered in detail, and the results are used to derive a general nonlinear transverse admittance relation. Crocco's time-lag hypothesis has been employed in the derivation of a concentrated combustion zone boundary condition. The latter together with the nozzle admittance relations have been used in the investigation of the nonsteady irrotational flow conditions inside combustion chambers of liquid-propellant rocket engines. These solutions were expressed as power series in terms of an amplitude parameter ϵ. The first term of this series was used to study the manner in which increasing the Mach number of the mean flow affected the linear stability limits. Results show that such an increase resulted in shifting of the unstable region, which is associated with the pure transverse acoustic mode, to higher values of the time-lag. First and second-order solutions were used to calculate the nonlinear pressure wave form; these theoretical predictions qualitatively agree with experimental results. The stability of finite amplitude waves was analyzed and the possibility of triggering combustion instability in the case of three-dimensional oscillations has been proven theoretically. This possibility has been verified experimentally.
Author

N66-29599# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONDITION OF COMBUSTION IN NON-THERMAL ACTIVATION OF COMBUSTIBLE MIXTURE
B. G. Khudenko 16 Feb. 1966 19 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 2, 1965 p 121-131
(FTD-TT-65-1776/1+2+4; AD-630288) CFSTI: HC $1.60/MF $0.50

Ratios are proposed which permit the evaluation of the activity of sources of ionizing radiation which will ignite a combustible mixture.
TAB

N66-29674# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CHARACTERISTICS OF FLUID FLOW THROUGH ORIFICES IN ROTATING DISKS
James William Wold (M.S. Thesis) Mar. 1966 65 p refs
(GAM/ME/66A-9; AD-632386) CFSTI: HC $3.00/MF $0.75

Rotating orifices were investigated recently as a means of cooling the window of a reentry vehicle. Besides intercepting thermal radiation, the rotating disk containing the orifices was believed to have reduced the flow of hot gases through the orifices. The study demonstrated with both air and water and with various disks that the flow rate can be reduced by increasing the orifice tangential speed. The results are presented graphically with the discharge coefficient C shown as a function of a non-dimensional velocity parameter S. At zero rotation (S=0) the discharge coefficient with air has values of 0.60 to 0.65, whereas at higher S values the discharge coefficient decreases to a range of 0.08 to 0.18. In the water tests values of S of 8.8 to 9.3 were obtained with corresponding-values of C ranging between 0.04 and 0.18.
Author (TAB)

N66-29682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF COUETTE FLOW AND HEAT TRANSFER BETWEEN PARALLEL PLATES ENCLOSING RAREFIED GAS BY MONTE CARLO
Morris Perlmutter Washington, NASA, 1966 32 p refs Presented at the 5th Intern. Symp. on Rarefied Gas Dyn., Oxford, England, 4-8 Jul. 1966
(NASA-TM-X-52218) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Couette flow and heat transfer through a hard-sphere rarefied gas enclosed between parallel walls are analyzed by a Monte Carlo procedure. In one case, both walls are stationary and at different temperatures. In the other case, the upper wall is moving, and both walls are at the same temperature. Sample molecule histories are followed across the channel, which has been divided into zones. The target molecules in each zone are assumed to have a different two-sided half-Maxwellian velocity distribution. By scoring the properties of the sample molecules as they pass scoring positions, the macroscopic quantities of interest, such as temperature, density, shear, and heat transfer, are obtained. Also, the average thermal velocity and number density in each zone are found and compared with the values assumed in the target molecule distribution. The problem is iterated until these values agree.
Author

N66-29703# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EXPERIMENTAL STUDY OF HEAT TRANSFER FROM A HEATED CIRCULAR CYLINDER IN TWO-PHASE, WATER-AIR, FLOW
Edmund Wataru Takahara (M.S. Thesis) Mar. 1966 78 p refs
(GAM-66B/ME/66-5; AD-632388) CFSTI: HC $3.00/MF $0.75

The rate of heat transfer is very sensitive to the quantity of water in the two-phase mixture and is 14.9 times greater than that for single-phase flow at a Re of 4.8×10^4. The film coefficient of heat transfer increases with Re but the amount of water in the boundary layer is the dominating factor. The local film heat transfer coefficient in two-phase flow is greatest at the stagnation point; it decreases with distance away from the leading edge and becomes essentially equal to the single-phase value at an angle where the liquid film separates from the cylinder. Author (TAB)

N66-29714# Columbia Univ., New York. Heat Transfer Research Facility.

FORCED CONVECTION BOILING BURNOUT FOR WATER IN UNIFORMLY HEATED TURBULAR TEST SECTIONS

Jack Griffel (Ph.D. Thesis) Washington, AEC, 25 May 1965 200 p refs

(Contract AT(30-3)-187)

(NYO-187-7) CFSTI: HC $5.00/MF $1.00

To thoroughly study the effects of the major variables in forced-convective burnout, 402 high-pressure critical heat flux determinations were made with seven uniformly heated, internally-cooled, tubular test sections using water, subcooled at the inlet, as the coolant. An analytical study of annular flow burnout based on observations and dimensional analysis yielded a correlation which relates the critical heat flux to the significant local fluid properties and flow parameters. This equation was used to correlate and study the critical heat flux data obtained together with a selection of additional data points from the major available sources, including data for freon-12. The equation contains four dimensionless groups and constants determined by regression analysis with a limited portion of the data. Critical heat fluxes calculated by the correlation are in good agreement with the measured values. Observations of the effects of the parameters in subcooled nucleate boiling burnout enabled the formulation of an empirical equation for this regime. The equation relates the critical heat flux only to the mass flow rate and subcooling. In testing the equation with available data it was found that the correlation holds throughout the 60 to 2000 psia pressure range equally well, thus implying that there is no pressure effect on subcooled burnout over this entire range. Author (NSA)

N66-29727*# National Aeronautics and Space Administration, Washington, D. C.

HEAT TREATMENT OF TUNGSTEN BULBS [OBROBKA CIEPLNA ZARNIKOW WOLFRAMOWYCH]

B. Jesionek and A. Kostkowski Jun. 1966 28 p refs Transl. into ENGLISH from Rudy i Metale Niezelazne (Kafowice) v. 10, no. 2, 1965 p 59–65

(NASA-TT-F-10185) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The present investigation had the purpose of establishing the optimal parameters of heat treatment for bulbs (filaments) of tungsten wire intended for the general series of light bulbs (25, 40, 60, and 100 w/220 v) which would ensure good mechanical properties of the filaments prior to mounting into the bulb as well as minimum deformation (sagging and warping) during the lifetime of the bulb. The investigation was carried out on GK grade of tungsten wire produced by the Zaklady Materialow Lampowych im. J. Grimau. A simultaneous objective was to establish a correlation between the recrystallization process and the character of the final wire structure after recrystallization, and to define the operating properties of the filaments. Author

N66-29746*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

STAGNATION-POINT SOLUTIONS FOR INVISCID, RADIATING SHOCK LAYERS

Walter B. Olstad (Ph.D. Thesis—Harvard Univ.) Apr. 1966 319 p refs

(NASA-TM-X-57696) CFSTI: HC $7.00/MF $1.75 CSCL 20M

A study of the influence of radiation on small and large blunt objects travelling at speeds up to 70 km/sec was undertaken. The parameters included the radiation cooling parameter, the Bouguer number, the surface reflectivity, and the spectral variation of the absorption coefficient. The analysis was limited to the stagnation region and the assumptions made are outlined. Approximate solutions were obtained for the following limiting cases: (1) a small perturbation expansion in the radiation cooling parameter valid when the influence of radiation is small; (2) a small perturbation expansion in the Bouguer number when the shock layer is optically thin; (3) the case when the shock layer is optically thick; and (4) the case when radiation is the principal mode of energy transport within the shock layer. These results are combined to give the radiant heat transfer rate and an estimate of the effect of radiation on the convective heating rate at the stagnation points. N.E.N.

N66-29765# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

THE EVAPORATOR TUBE—STATE OF THE ART

S. William Gouse, Jr. and Andrew J. Dickson 31 Dec. 1965 77 p refs

(Contract Nonr-1841(73))

(DSR-8734-7; AD-632124) CFSTI: HC $3.00/MF $0.75

The purpose of this study was to examine the literature on the forced or natural convection flow of an evaporating and/or boiling fluid in tubes and channels of various geometries and orientations, with emphasis on those conditions where the flow enters the heated section at the saturation temperature, and leaves after net vapor generation has taken place. No attempt is made to review all of the correlations and experiments that are currently available in the literature—only those which seem to have received significant support from a variety of users. Author (TAB)

N66-29789# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

MEASUREMENT OF THE TRUE SPECIFIC HEAT OF SILVER, NICKEL, β-BRASS, QUARTZ AND QUARTZ GLASS BETWEEN 50 AND 700°C BY AN IMPROVED METHOD [MESSUNG DER WAHREN SPEZIFISCHEN WARME VON SILBER, NICKEL, β-MESSING, QUARZKRISTALL UND QUARZGLAS ZWISCHEN +50 UND 700° NACH EINER VERFEINERTEN METHODE]

Helmut Moser Bedford, Mass. AFCRL, Feb. 1966 53 p refs Transl. into ENGLISH from Physik. Z. (Germany), v. 37, 1936 p 737–753

(Contract AF 19(628)-5034)

(G-T-G-65-9; AD-631200) CFSTI: HC $2.00/MF $0.50

A silver calorimeter, equipped with a resistance heating element which surrounds the sample, is placed in an electric furnace whose temperature can be brought to 700°C at constant rate. The calorimeter is held in an argon atmosphere at reduced pressure. The method permits measurement of true specific heat of solids between +50 and +700°C

within 0.5 percent (absolute), with suitable calorimeter construction and consideration of all sources of error. The measurements of true specific heat of silver, nickel, beta-brass, crystalline quartz and amorphous quartz show even smaller relative deviations. TAB

N66-29800# Ohio State Univ. Research Foundation, Columbus.
FORMATION OF DETONATION WAVES IN FLOWING COMBUSTIBLE GASEOUS MIXTURES AND LIQUID-SPRAY MIXTURES Final Report, 1 Feb. 1965-31 Jan. 1966
Loren E. Bollinger and Rudolph Edse 15 Mar. 1966 11 p refs /ts Rept.-1
(Grant AF-AFOSR-203-65)
(AFOSR-66-0695; AD-631786) CFSTI: HC $1.10/MF $0.50

Detonation induction distances were determined in a 9-mm inside diameter detonation tube at an initial pressure of 1 atm at ambient initial temperature for hydrogen–oxygen mixtures flowing at initial velocities ranging from 1–100 meters/second and for methane–oxygen mixtures flowing at velocities ranging from 0–30 meters/second. Some experiments with hydrogen–oxygen mixtures were conducted at 5 atm initial pressure. The results show that the induction distances for hydrogen–oxygen mixtures decrease linearly with the logarithm of the Reynolds number based on the initial linear gas velocity. The induction distance of the detonation wave propagating upstream is shorter than that of the wave propagating downstream. Induction distances in methane–oxygen mixtures were essentially constant over the range of flow velocities employed. Certain observations seem to indicate that higher turbulence levels in the initial gas flow cause an effective decrease in the quenching diameter. Author (TAB)

N66-29806# IIT Research Inst., Chicago, Ill.
FIRE STORM ENVIRONMENTAL MODEL Final Research Summary Report
Hugo J. Nielson Apr. 1965 110 p refs
(Contract OCD-PS-64-50)
(AD-618711) CFSTI: HC $4.00/MF $0.75

To further define the environment within a fire storm, an analytical model was developed which describes the conditions of flow and temperature of the fluid. In the model, the fire is considered to be an area on the ground with a temperature above that of the surroundings. The motion of the fluid produced by the temperature excess was obtained by solution of the equations of energy, motion and continuity by a numerical integration technique. Effects of viscosity and of thermal conduction are included in the analysis without the boundary layer approximations that were used in a previous analysis of the convection column. For this reason, the results obtained in the region near the ground are not subject to the deficiencies of those of the previous analysis. Some of the effects of swirling flow are also included in the model by specification of rotation in the surrounding air. A simplified analysis was also conducted to estimate the time required for the development of swirl flow. In the analysis, the entrainment by a convection column is represented by a line sink. A simple solution is presented for rate of growth of swirl flow for a fluid initially rotating at a speed that corresponds to the rotation of the earth. Author

N66-29819# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION AND PROPERTIES OF COMBUSTIBLE SUBSTANCE
P. G. Demidov 27 Aug. 1965 376 p refs Transl. into ENGLISH of the book "Goreniye i Svoystva Goryuchikh Veshchestv" Moscow, Izd. Min. Kommun.-Khoz. SSR, 1962 p 1–264 (FTD-MT-64-381; TT-65-64034; AD-621738) CFSTI: HC $7.00/MF $1.75

Contents: General information on combustion. Oxidation of combustible substances. Self-ignition; Spontaneous combustion; Ignition (deflagration); Combustible properties of mixture of vapors and gases with air; Combustible properties of dust mixtures; Burning of liquids; Burning of solid substances; Cessation of the process of burning. TAB

N66-29850# California Univ., Berkeley.
STUDY OF THE DEVELOPMENT AND STABILIZATION OF DETONATIONS Final Report, Oct. 1964-Oct. 1965
A. K. Oppenheim [1965] 7 p refs
(Grant AF-AFOSR-129-65)
(AFOSR-66-0777; AD-632575) CFSTI: HC $1.00/MF $0.50

The main objective of the work was to investigate the processes that govern the acceleration of combustion waves in reactive gas mixtures, to identify the mechanism of the onset of detonation, and to study the multidimensional wave interactions which characterize the structure of the so-called spinning detonation. TAB

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-28916# Hokkaido Univ., Sapporo (Japan). Faculty of Engineering.
BULLETIN OF THE FACULTY OF ENGINEERING, NUMBER 37
Jun. 1965 60 p refs In JAPANESE; ENGLISH summary
CFSTI: HC $3.00/MF $0.50

CONTENTS:

1. STRUCTURES OF PROPYLENE POLYMERS PRODUCED BY CATALYTIC POLMERIZATION WITH SOLID PHOSPHORIC ACID Hiroshi Ohtsuka, Kazuo Aomura, and Masanori Kawabata p 1–17 refs

2. SYNTHESIS OF FIBROUS POTASSIUM TITANTE BY FLUX (K_2O-B_2O_3 SYSTEM) EVAPORATION METHOD H. Saito and N. Takusagawa p 19–25 refs (See N66-28917 16-06)

3. SYNTHESIS OF AN INORGANIC OILY SUBSTANCE FROM THE REACTION OF PHOSPHONITRILIC CHLORIDE TRIMER WITH PHOSPHORUS PENTACHLORIDE Hajime Saito p 26–35 refs

4. THE STABILITY OF ASYMMETRICAL DOUBLE ROWS OF VORTICES IN A UNIFORM SHEAR FLOW M. Kiya and M. Arie p 37–49 refs (See N66-28918 16-12)

5. ESTIMATION OF CHARACTERISTICS OF TWO BRANCHED FRANSIS TURBINES IN PARALLEL RUNNING M. Arie, S.-i. Iida, M. Mitani, and T. Yamazaki p 51–58 (See N66-28919 16-03)

N66-29014# Brookhaven National Lab., Upton, N. Y.
[PHYSICAL SCIENCES AND ENGINEERING, LIFE SCIENCES, AND SUPPORTING ACTIVITIES] Annual Report, 1 Jul. 1964-30 Jun. 1965
Nov. 1965 245 p refs
(Contract AT(30-2)-GEN-16)
(BNL-929) CFSTI: HC $6.00/MF $1.25

The research program and activities of the Brookhaven National Laboratory during 1965 are described. Research efforts devoted to particle physics, atomic and molecular physics, neutron physics, nuclear structure, and solid state physics are summarized. Activities associated with operation, maintenance, and improvement of the Brookhaven cosmotron and alternating gradient synchrotron are discussed. Activities connected with developing and procuring instruments and systems for research projects are presented. Progress is reported in nuclear chemistry on high energy nuclear reactions, nuclear spectroscopy, solar neutrino experiments, meteorite studies, geochemistry, and archeological studies. Studies in radiation chemistry, hot atom chemistry, molecular and crystal structure, isotope effects, and physical chemistry are also reported. Results of research on fundamentals of reactor physics, chemistry, and metallurgy are presented. Studies in reactor materials, liquid-metal heat transfer and containment, and direct conversion of heat to electricity are summarized. Progress on differential and integral equations, statistics, kinetic theory, and mathematical physics is reported. Biological and medical research activities are also described. R.N.A.

N66-29268# California Univ., Berkeley. Operations Research Center.
ON OPTIMAL DEVELOPMENT IN A MULTI-SECTOR ECONOMY
David Gale Apr. 1966 44 p refs
(Contract Nonr-222(83))
(ORC-66-11; AD-632495) CFSTI: HC $2.00/MF $0.50

An economy is considered that has n goods and k types of labor, each of which is growing at the same constant rate. Goods are produced from labor and other goods by a set of specified activities. Given an initial supply of goods and amounts of labor. All possible production programs running from the present time to infinity through discrete time periods are considered. With each program is associated a utility sequence measuring the satisfaction achieved by the program at each period of time. A program is optimal if its utility sequence overtakes all other such sequences. The paper is devoted to proving the existence of optimal programs for a wide class of economies and to deriving the properties of such programs. In particular it is shown that the optimal program approaches a certain balanced program. Essential use is made of the existence of an infinite sequence of optimal prices with respect to which the optimal program is one which maximizes the sum of profit and utility at each time period.
Author (TAB)

N66-29307# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
CATALOGUE OF PUBLICATIONS AND TECHNICAL NOTES [CATALOGUE DES PUBLICATIONS ET NOTES TECHNIQUES]
1 Jan. 1966 86 p refs In FRENCH and ENGLISH
CFSTI: HC $3.00/MF $0.75

Aerospace research publications and technical notes, prepared by the French National Office of Aerospace Studies and Research, are cataloged for 1947 through 1965. Some of the topics covered in the abstracts are: theoretical and experimental aerodynamics, wind tunnel descriptions and measurements, turbulence, fluid magnetodynamics, propulsion systems for rockets, ram and turbo jets, flow properties, alloys and refractory metals, sintering, plastic materials and adhesion, chemical and physical analyses, mechanical and physical properties of materials, optics, spectrography, servomechanisms, stabilization, acoustics, plasma physics, flutter, and vibrations. An author index is appended. R.U.

N66-29337*# George Washington Univ., Washington, D. C.
A SURVEY OF SOME ELEMENTS IN AMERICAN TECHNOLOGY
Charles Madison Bacon Nov. 1964 45 p refs *Its* PPSST Paper No. 3
(Grant NsG-729)
(NASA-CR-57431) CFSTI: HC $2.00/MF $0.50 CSCL 05H

Scientific and technological developments have had a prolific as well as a cumulative effect. Not only has more knowledge been added to the storehouse of technology, but all inventions spawn others. One of the important considerations in a survey of American technology is the role of the federal government. The present close relationship between government and science has its historical roots in the early days of the nation. Though the consensus of the founding fathers was not in favor of government-sponsored science, the crises and growing pains of the nation have created our present government-science structure. An examination of certain fields of technology indicates that the record is not one of steady progress. Many early innovations were ignored and experimental scientists were ridiculed. Americans have traditionally been more interested in utilitarian technology than in fundamental research, but there is some indication that more attention is being given to basic research and the development of new scientific principles. Author

N66-29571*# George Washington Univ., Washington, D. C. Program of Policy Studies.
PLANNING, PROGRAMMING AND BUDGETING: A TECHNIQUE FOR FEDERAL PROGRAM PLANNING AND DECISION-MAKING
Robert G. Smith 24 Nov. 1965 32 p refs
(Grant NsG-727)
(NASA-CR-75897) CFSTI: HC $2.00/MF $0.50 CSCL 05A

A Presidential proposal for the adoption of a planning-programming-budgeting system by key government agencies is discussed, and its evolution and possible impact is analyzed. The integrated programming and budgeting system introduced into the Department of Defense, which resulted in more centralized decision-making, is assessed, and its impact on the defense industry is considered. The proposed system is defined as a management technique for systematically defining primary objectives and alternatives, then matching these objectives and alternatives to the appropriate resources within a structured information matrix. The technique is designed to assist top management in its planning, decision-making, and directive responsibilities. Inherent in the plan is a complex analytical process defined as systems, cost/utility, or cost effectiveness analysis. The current appropriations structure is compared with the suggested program structure for the Federal Transportation Program as an example of the changes which are involved. Details are also given on the proposed annual budget cycle which would operate over a 12-month period. Personnel acceptance or rejection of the system is viewed as a problem, and possible solutions are proposed.
M.G.J.

N66-29744*# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1967
Washington, GPO, 1966 143 p Report of Comm. on Aeron. and Space Sci. on HR 14324, 89th Congr., 2d Sess. CFSTI: HC $4.00/MF $1.00 CSCL 05A

The amendments proposed by the Senate to the bill authorizing appropriations to NASA are presented. Comparative data are given on the original budget request, the House approved funds, and the Senate committee action for the programs involved in the overall areas of research and development, construction of facilities, and administrative operations. The reasoning accompanying the House reductions and the Senate restorations is enumerated, and the several legislative changes made by the committee are discussed. The objectives and requirements of each program are detailed. Space and space-related programs of the Department of Defense, the Atomic Energy Commission, the Environmental Science Services Administration, and the National Science Foundation are summarized, and the budget authorizations are listed. Supporting data requested by the Committee on several programs are included. M.G.J.

N66-29922# Michigan State Univ., East Lansing. Dept. of Statistics.
FLOODING MODELS
J. Gani 22 Dec. 1965 20 p refs Presented at the W.R.A. Reservoir Yield Symp., Oxford, 21–23 Sep. 1965 Prepared in cooperation with Sheffield Univ.
(Contract Nonr-2587(05); Grant NIH GM-13138-01)
(MSU-RM-149; JG-10; RR-4/JG-3; AD-631057) CFSTI: HC $1.60/MF $0.50

The purpose of the present paper is to propose mathematical models for a river system on which a sequence of dams is built whose principal function is the prevention of flooding (the model may also be of relevance in the control of river pollution). Instead of attempting to obtain explicit solutions to such models for some simple input distributions, the practical use of Markov chain methods in the deriving probabilities of flooding when the inputs are assumed to be dependent random variables forming a non-homogeneous Markov chain will be demonstrated. Author (TAB)

N66-29932# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SUBSURFACE TRANSPORTATION METHODS IN DEEP SNOW
Gunars Abele Dec. 1965 54 p refs
(TR-160; AD-631949) CFSTI: HC $2.00/MF $0.50

During the 1962 test season in Greenland, a study was performed on subsurface transportation methods. A 1600 ft long, covered test trench containing horizontal curves and a 400 ft long processed snow floor section was constructed. Wheel trafficability tests on the snow trench floor were conducted with two types of low-pressure tires as well as with standard truck tires. An M-54 5-ton truck with a 5-ton load was used as the test vehicle. Skid tests were performed with the three types of tires on the processed snow floor, and the coefficient of friction between the tires and a hard snow surface was determined. A 1300 ft long, standard gage railroad track was installed in the trench after completion of the wheel traffic tests. A standard size flatcar with a 30-ton load, towed by a 5-ton truck equipped with rail wheels, was used as the test vehicle for the rail traffic tests. It was determined that the natural, unprocessed snow surface in a trench 26 ft below the snow surface is not suitable for extensive traffic with vehicles such as 5-ton trucks even when equipped with low-pressure flotation tires. However, a Peter plow-processed, age-hardened snow surface is capable of supporting a virtually unlimited amount of vehicle traffic using standard tires. Indications are that even heavier wheeled vehicles could be easily supported by a processed-snow trench floor. The coefficient of friction between rubber tires and a hard snow surface was found to be in the general range of 0.2 to 0.3. Author (TAB)

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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